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American Machinist

A Practical Journal of Machine Construction

Issued Weekly by the Hill Publishing Company : : : 505 Pearl Street, New York

Price 15 Cents, $4.00 per Year

Contents 463. Advertising Index 51

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Hundreds of shops have not only used up all *old* drills and reamers that had been discarded but have, in addition, eliminated this breakage and waste by driving new tools with "USE-EM-UP" sockets. Drilling efficiency can be increased nearly 50% with the "USE-EM-UP" drive.

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(*See pages* 43, 44, 45 *and* 46)

Building Machinery for Bakers

By F. A. Stanley

Some unusual operations in building up metal "agitators" for mixing materials of various kinds; coiling flat stock, forming it to shape and attaching it to the agitator spiders.

How a peculiar casting is handled in the engine lathe. Homemade grinding machinery for performing operations on some peculiar castings requiring to be finished internally.

Operations on various parts used in the construction of dough mixers, druggists' and laboratory machinery, paint mills and other apparatus.

The J. H. Day Company, Cincinnati, Ohio, manufactures lines of machinery for bakers, confectioners, manufacturing druggists, paint makers and others and some of this apparatus as well as the methods under which it is built should be of interest to readers of the AMERICAN MACHINIST, as a good many of the processes are quite unusual in their character.

BUILDING UP AN AGITATOR

The halftone, Fig. 1, illustrates a number of "agitators" of various sizes which are used in different types of mixing machines for handling powdered material and other substances of a light nature. The mixing apparatus constructed by this firm is made not only for powders and thinly mixed pastes, but also for bread and cake dough and many other substances, which in the process of manipulation become very stiff and, therefore, require a strong and heavy agitator, which is made of cast iron, and specific reference to which will be made at another point in this article. Referring for the moment to the agitators in the first illustration, it will be noticed that these are built up of flat steel strips wound in a helix from end to end, the outer helix being wound one hand and the inner the opposite way. The flat steel strips are secured in cross bars, which are either slipped through holes drilled crosswise in the main shaft, or else carried by hubs bored to fit over the shaft. The cross bars of the smaller sizes are slotted at the opposite ends to the required angle to receive the flat strips as they are bent to shape. On the larger agitator the blades are attached to the outside of the supporting cross bars.

This type of "agitator" works the material in a sheet-metal tank, whose bottom is approximately to the same radius as that of the agitator itself; and owing to the blades of the agitator being shaped to opposite hand, the material undergoing the working process, is worked to both right and left in the tank and thoroughly mixed.

CAST-IRON WINDING FORMS

For the smaller agitators the metal strips forming the spiral blades or beaters are wound upon special fixtures of the type illustrated in Fig. 2. These are adapted to screw onto the threaded nose of the lathe spindle and one end of the material is secured in the clamp shown on the face of the mandrel so that by turning the spindle the band is readily coiled in the helical groove formed from one end of the mandrel to the other. The strips for the larger sizes of agitators are bent to templets partly by power and partly by hand. In either case after the coils are made they are elongated and the curvature made to conform to an approximately true helix around the agitator spider.

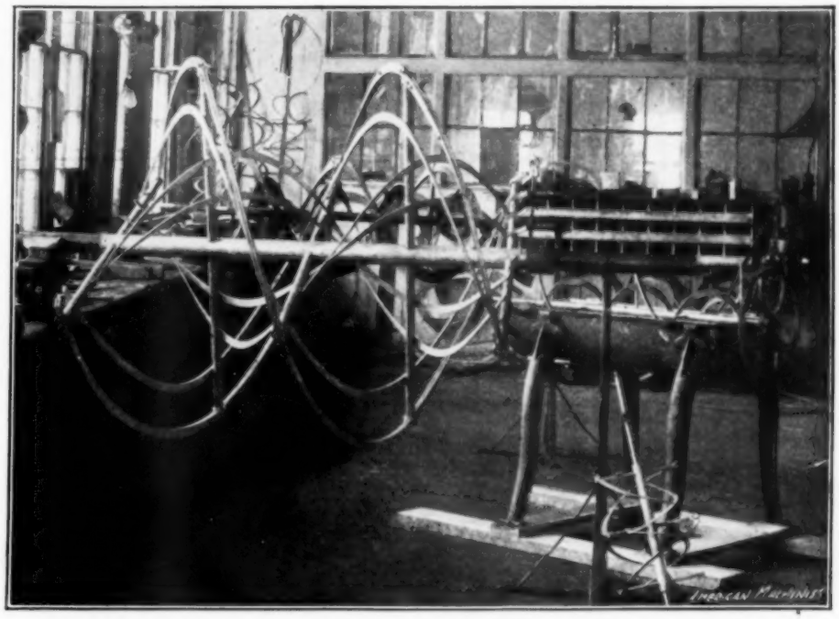


FIG. 1. AGITATORS FOR MIXING MACHINES

After the agitators are built up complete they are ready for galvanizing and are then mounted in suitable bearings in the mixing machine. The largest size seen in the photograph, Fig. 1, is about 4 feet in diameter and 6 feet long; similar parts are made at this shop as large as 5 feet in diameter and up to 8 feet in length.

AN AWKWARD CASTING IN THE LATHE

Fig. 3 represents an operation as performed upon a cast-iron agitator, reference to which has already been made. These castings are first centered, mounted between the lathe centers and the trunnions or hubs at the ends turned to diameter. The edges of the wings are also machined so that they will fit closely enough in the sheet-metal tank when in operation. For boring the hubs to receive the supporting and driving shaft, one end of the work is grasped in the chuck as shown, while the other end is carried in the steady rest. The tool in the lathe is represented as facing off the end of the hub. The boring and facing operations at the opposite end are accomplished in similar fashion after the work is reversed end for end.

HOME-MADE GRINDING APPARATUS

The grinding machine, Fig. 4, was constructed here for performing certain operations upon cast-iron pots or hoppers for paint mills and other apparatus. In this view it is represented as set up for grinding out the interior of a spherical casting forming the principal member of a "ball mill" for pulverizing drugs, dry colors and other materials by means of a number of heavy cast-iron balls thrown into the mill along with the substance to be ground.

An illustration of such a mill is shown in Fig. 5, which illustrates the

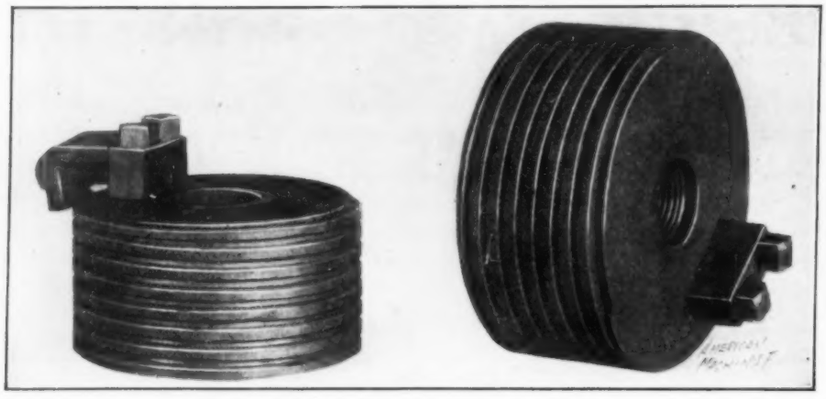


FIG. 2. MANDRELS FOR WINDING AGITATOR COILS

angular position of the apparatus and the method of driving the pot in which the grinding process is carried on. While, naturally, the interior of the receptacle does not require finishing with any degree of accuracy, it is desirable that it should be provided with a smooth surface, and for this work the grinder, Fig. 4, is well adapted. The spindle of the machine may be slid to and fro in its bearings by means of a hand lever, the wheel stand may be moved transversely by the feed screw and different forms and sizes of grinding wheels are provided for finishing various shapes of castings. In the case illustrated the wheel of spherical form is shown in place on the spindle. The work itself is mounted in a 4-jaw chuck. The operator controls the travel of the wheel around the interior of the work by operating the cross-slide screw for the wheel stand and the lever for the end movement of the spindle.

ANOTHER GRINDING OPERATION

Figs. 6 and 7 show the method of grinding the interior of a conical part for another type of mill. In this construction a series of grooves are provided in the lower end of the casting and corresponding grooves cut in the upper face of a disk which revolves in contact with the lower surface of the pot, the teeth formed by the two sets of grooves crushing and grinding whatever material is fed into the machine.

As set in Fig. 6, the grinding machine for the conical vessel is ready for finishing the cylindrical neck in the bottom of the casting for the reception of the rotating notched disk. In Fig. 7 the same machine is illustrated with the head swiveled to the proper angle for grinding the conical interior. In both these settings the wheel is fed through the work by the hand lever operating the spindle and is fed to the cut by means of the screw under the wheel stand.

The work is held in the four-jaw chuck as in the case of the spherical casting. Various other jobs are put on this machine and where not adapted for gripping

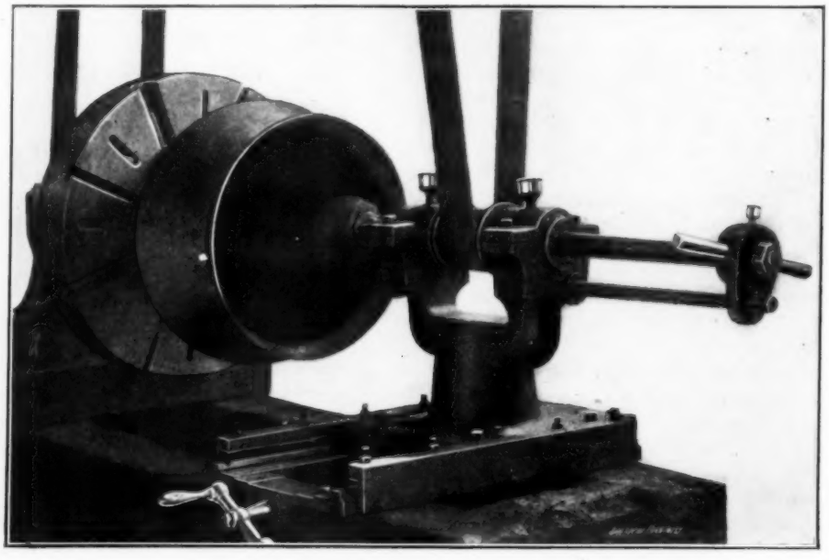


FIG. 4. A HOMEMADE GRINDING MACHINE

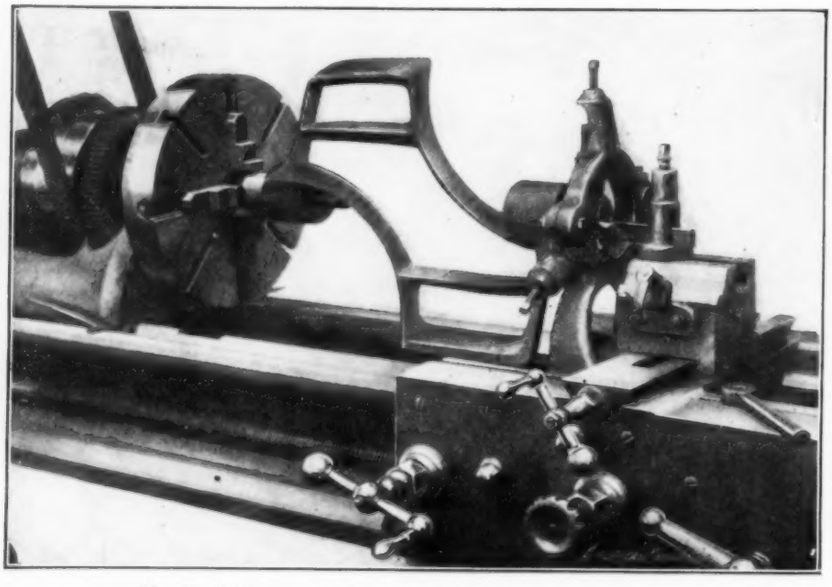


FIG. 3. A CAST-IRON AGITATOR MACHINED IN THE LATHE

FIG. 5. A POT MILL FOR GRINDING DRUGS, DRY COLORS, ETC.

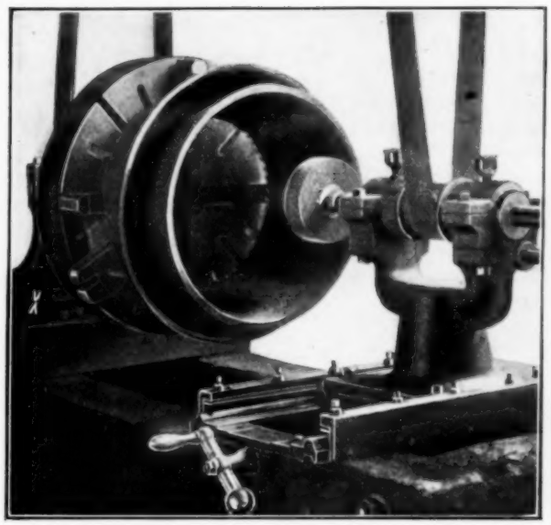


FIG. 6. GRINDING A CONE-SHAPED CASTING

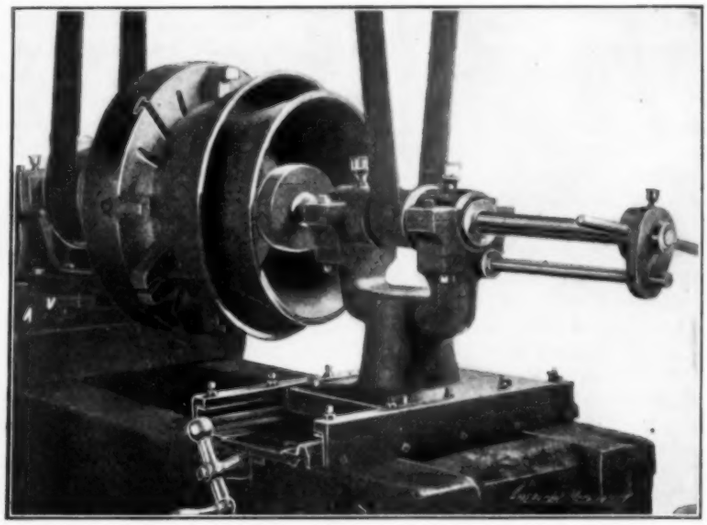


FIG. 7. GRINDER HEAD SWIVELED FOR FINISHING A CONICAL SURFACE

in the chuck they are mounted on suitable faceplate fixtures.

MILLING AN UPRIGHT

The milling machine, Fig. 8, is shown in operation upon a casting which is of an awkward form to handle. This is an upright for a vertical mixing machine and is about 4 ft. high, with a series of rack teeth on the inner face and a dovetail bearing surface at the upper end. The casting carries a bearing bracket for the main shaft through the mixing paddler and a pinion on a handwheel shaft through the bracket meshes with the rack teeth cast on the face of the upright. A handwheel is operated for turning the pinion shaft and thus lifting the agitator out of its tank.

The dovetail bearing surfaces are milled accurately in the fixture shown on the machine in Fig. 8. The vertical rib extending for the greater part of the length of the casting rests on jackscrews, and clamp screws through the top of the fixture act upon the upper side of the rib. The method of supporting the base of the casting will be understood from the illustration.

A shank milling cutter which will be noticed upon the table of the machine is used to mill the edges of the casting in reducing it to the proper width prior to forming the dovetail surface, and also faces the flat surfaces at either side of the rack. The dovetail cutter is then put in place in the spindle, a roughing cut is taken along the upper edge, the table elevated and the lower edge of the work roughed out. A finishing cut is then taken from both edges, suitable gages being used to secure the proper width of dovetail.

In order better to represent the general character and size of the casting it is shown in Fig. 9 with a man of average hight, who is represented in the act of measuring the width of the bearing with a micrometer caliper.

CAST-IRON AUGERS

The parts shown in Fig. 10 are known as "augers." They are usually of cast iron, though sometimes of brass or bronze, and they are used in automatic machines for packing powders, and other

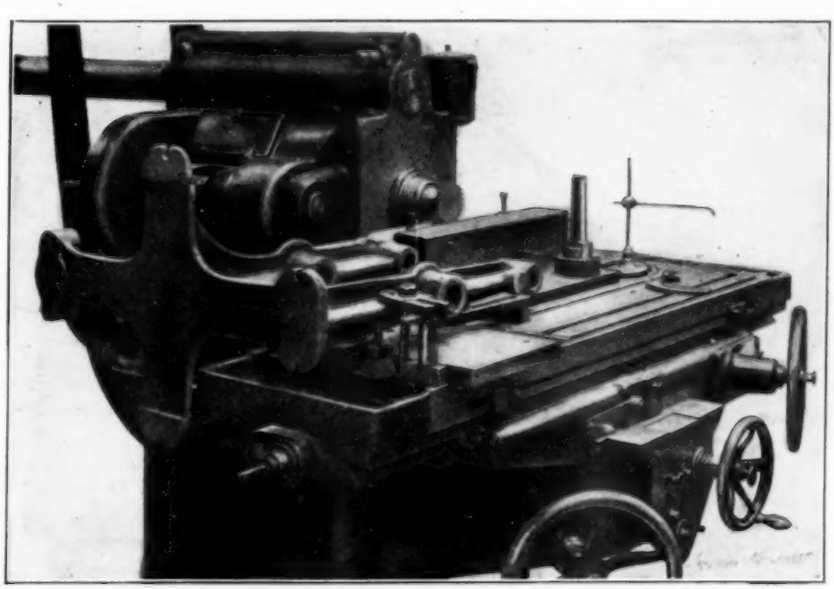


FIG. 8. MILLING DOVETAIL BEARING SURFACE ON AN UPRIGHT

FIG. 9. GENERAL FORM AND SIZE OF UPRIGHT

materials into paper cases, tin boxes, tubes, etc. The "auger" is threaded to screw into the lower end of a vertical spindle which is gear driven from the top, and which passes down through a hopper into which the substance to be packed is poured. The "auger" is turned on the outside to fit fairly closely in a tin funnel attached to the under side of the hopper, the lower end of the funnel carrying the substance into the receptacles into which it is forced by the action of the rotating "auger." The latter being left handed and revolved to the right presses the material downward until the box or tin has been packed with the desired amount as determined by weight (the box resting upon the platform of an automatic weighing device), and then the action of the apparatus is mechanically shut off.

These "augers" are made in numerous sizes and in various pitches; some are straight and some are taper. The design in each case is determined by the character of the substance to be packed, and the form of receptacle into which it is to be packed.

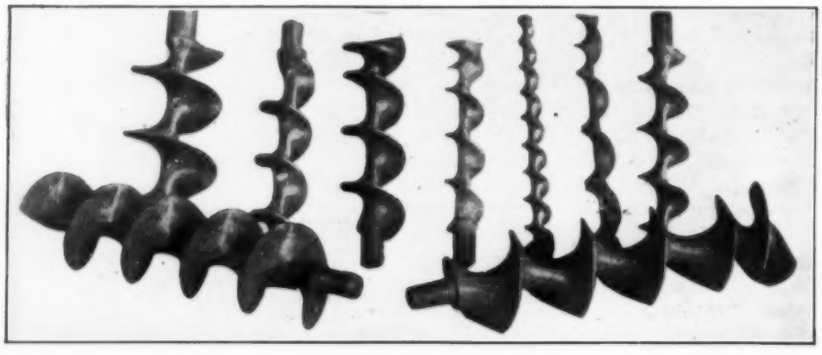


FIG. 10. A GROUP OF AUGERS FOR AUTOMATIC PACKING MACHINES

Educating to Prevent Accidents*

BY FRED H. COLVIN

While appreciating the work that is being done by the apprentice system of the New York Central Lines, I believe the scope of this education can be gradually broadened, so as to make better machanics and better citizens.

You are doing good work in teaching the boys the fundamentals of mechanics and shop mathematics, and in training them for the production of good work at a reasonably rapid rate. Increasing the output of any machine by using improved methods rather than depending upon increased manual effort is true conservation of the capital invested. In a like manner the conservation of the workman is equally important in the broad economical view of his relation to manufacturing and to the community.

Nearly all the States are paying considerable attention to the problem of compensation for injured workmen, and there is no doubt that we will follow in the footsteps of the older countries in this respect. This question is unfortunately usually discussed in the attitude of antagonism by both sides, instead of from a standpoint of mutual interest. Under the guidance of your instructors, or even a special instructor who can cover other points of a similar nature at your various schools, who has a real personal interest in the boys and their welfare and who commands their confidence, the proper relation between employer and employed can be made clear and helpful to both.

One of the difficulties with all corporations is that of instilling workmen with the idea of individual responsibility, both to the company and to their fellow employees. An instructor of this kind could do much toward pointing out this individual responsibility in the way of properly caring for machines and tools, so that they would not be a source of danger to themselves or others. He could make clear the penalties of taking chances with a belt which needed lacing or cementing, of unnecessarily going into dangerous places, and many other points which are responsible for more injuries than any of us realize.

It is not solely a question of compensation, but one of economic loss to the individual and to the community. Even if the injured workman receives full wages, there is a distinct loss in the production of that shop, and this indirectly is shared by him as an individual member of the community, and to every man in the shop, whether he or they realize it or not.

Everything which is destroyed represents cost to someone. A nut or washer shied at a dog and not recovered is a distinct loss, just as is the destruction of a man's usefulness through unnecessary accidents. Guards must be used to be of value. The time will come when failure to use them may mean dismissal, as the responsibility cannot all be placed on one side.

There is no question that the economic and political future of this country depends largely upon the intelligence of its workmen, and anything that we can do that will aid in the formation of a broad foundation cannot fail to be a lasting benefit to ourselves and to our various communities.

There are many other fields of education which vitally affect every manufacturing industry, but considering the accident question alone, I am convinced that their number can be materially reduced by educating men along these lines. Any reduction in the number of accidents is a distinct gain from any point of view, and there is no question but that education can help in this direction, as well as any other. It is very often less a matter of carelessness than of a recognition of individual responsibility.

Whether this work should be done in your classroom or at special meetings is a matter of detail. It is even possible that much of the work can be done by the shop instructors, who have practical examples constantly before them.

But in whatever way this may be worked out I firmly believe that something along this line can be done, and that it will not only prove economical in a financial way, but will tend to bring about a closer and more friendly understanding with the boys and the men.

*A paper before the conference of New York Central Apprentice Instructors.

Foundry and Machine Shop Equipment Exhibit

The sixth exhibit of foundry and machine-shop equipment, held in connection with the convention of the American Foundrymen's Association, will open in Pittsburg, Penn., on May 22, and arrangements are being made to have it more comprehensive than ever before. The exhibits last year covered 34,000 square feet and the total weight, as compiled from railroad bills of lading, was over 600,000 pounds. Larger exhibition space will be required this year and in addition to Mechanical Hall it is planned to erect one or more temporary buildings. This is the joint session of the American Foundrymen's Association, the American Glass Foundrymen's Association and the American Foundry Foremen's Association. The exhibits are in charge of the Foundry and Machine Exhibition Company, C. E. Hoyt, secretary, Lewis Institute, Chicago, giving all necessary information in regard to it.

Now that Prussia has elevated a plumber to the House of Lords, the machinist can take heart and look for higher honors from the government.

Machining Cylinders and Eccentrics

By M. E. Hoag

Planing small locomotive cylinders before boring and the way the partly machined casting is placed and held on the horizontal boring mill.

Eccentrics bored, keyseated and turned in a short time and with little trouble.

A chuck for driving-rod brasses and a boring-mill jig for driving wheels.

At the time I visited the Davenport Locomotive Works, at Davenport, Ia., their new shops were just completed and only part of the machinery in place, and it was impossible to secure photographs of the shops in general, so in this article only a few of the many interesting things to be found there are shown, but I hope at some future time to be able to place before the readers of the AMERICAN MACHINIST a more complete description of these shops and their product, which consists of small locomotives for logging, mining, yard and similar work.

METHOD OF HANDLING CYLINDERS

It is general practice in locomotive shops to bore the cylinders, face the flanges and then do the planing, setting up from the finished bore. This leaves considerable to the planer hand besides taking a lot of time to get the work lined up, but in this shop the operations are reversed, the planing being all finished and the ports milled as shown in Fig. 1, before the cylinders are sent to the horizontal boring machine.

For this boring operation, special fixtures are used and the cylinder is located from the recess shown at *A*, and as the corresponding boss on the boring fixture is the correct distance from the

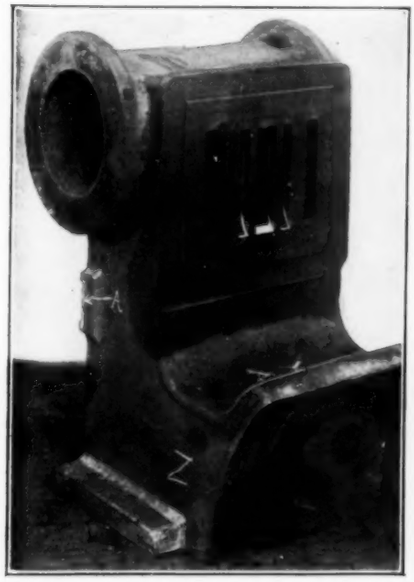


FIG. 1. MANNER IN WHICH CYLINDER CASTINGS ARE PLACED AND PARTS MILLED BEFORE CYLINDERS ARE BORED

center of the boring bar and is dead in line with the travel of the machine, the bore must of necessity come true and square with the planed surfaces, and correct for distance, leaving practically no item of importance to the judgment of the operator.

Fig. 2 shows a Barrett boring machine with fixtures and a cylinder in place. The attachments *A A* carry the facing tools, the feed being operated by the star wheels *B B* striking pins in the blocks *C C* as the fixture revolves.

By doing the work in this way, more accurate results are obtained, and the time reduced, a pair of 10x16-inch cylinders being planed and bored in 11 hours.

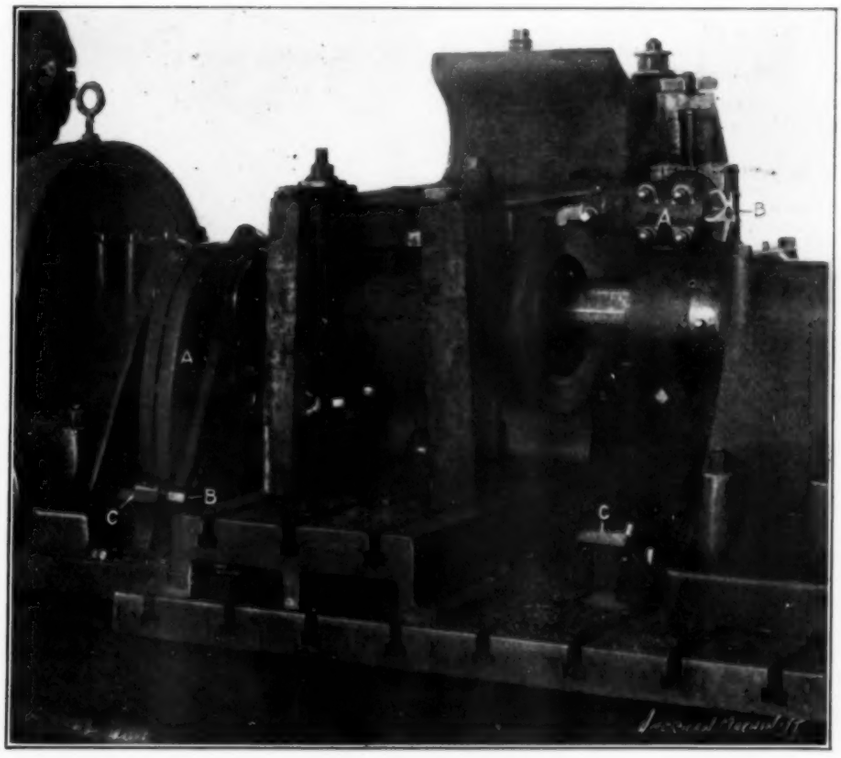


FIG. 2. BORING AND FACING THE CYLINDERS ON A HORIZONTAL BORING MILL

BORING AND TURNING ECCENTRICS

In machining the eccentrics shown at *A*, Fig. 3, another departure is made from regular practice, the boring being done under a radial drill with the boring head shown at *B*, after which they are keyseated, and a gang of four placed on a keyed arbor and turned on the outside diameter. The axles are quartered and keyseated in a special fixture, so that in assembling no fitting or milling is necessary as in the ordinary method of doing this work. By boring these eccentrics in the radial drill the labor rate was reduced one-third and the production doubled.

BORING DRIVING ROD BRASSES

A very handy chuck for boring driving-rod brasses, is shown at *C*, Fig. 3. This chuck is used for all sizes of work by changing the side blocks which are interchangeable, one of an extra pair being shown at *D*. Each pair of blocks is stamped with the size, type and bore of the brasses for which they are intended.

MACHINING DRIVING WHEELS

The drivers for these small locomotives are turned, bored, and the hub faced at one setting, in a vertical boring mill, as shown at *A*, Fig. 4, and are handled very rapidly by use of the fixture shown at *B*, which is located on the boring mill by a plug that fits the center holes in the machine table and fixture. After the fixture is located and bolted in place the plug is removed to permit the passage of the

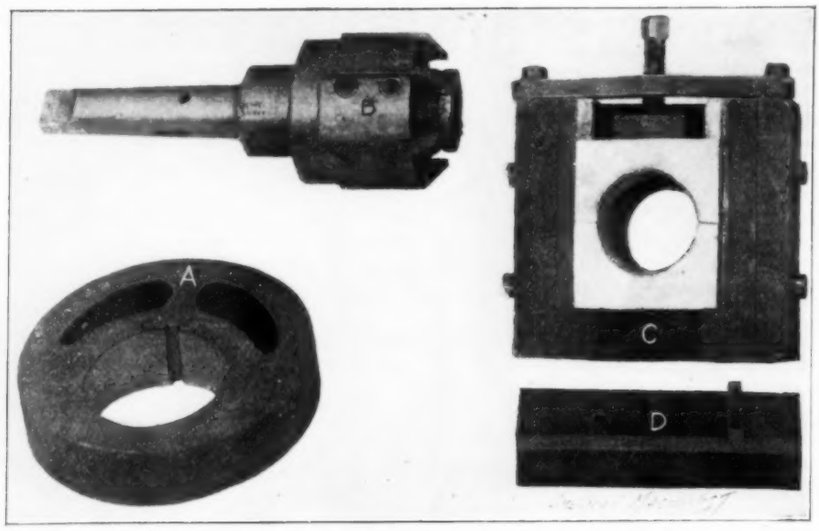


FIG. 3. AN ECCENTRIC AND A BORING TOOL TOGETHER WITH A DRIVING ROD BRASS CHUCK WITH INTERCHANGEABLE JAWS

boring bar. No locating nor truing up of the wheel is necessary, other than dropping it into the slots shown at *C C*, and fastening it down with two clamps.

The smaller driving wheels are bored and the hubs faced in a drill press, the position of the holes being located by the use of a master plate.

These shops are using some of the very best standard machine tools on their work, besides many very interesting tools and fixtures of their own design, and when all the machinery is in place and running, they will be model shops in many ways.

Making Ones Own Jigs and Tools

BY ENTROPY

If a man should sell machine tools at the cost of direct labor and material plus a 10 per cent. profit, he would expect to see the sheriff on the doorstep in the near future. As a precautionary measure he finds out the amount of his overhead charges and adds them to the direct costs in such proportions as strike his fancy or as seem to him scientific. Among those overhead charges is a considerable expense for tools, jigs, etc. The making of those tools and jigs has involved the use of power, heat, light, room, oversight, oil, waste, in fact, practically all of the overhead charges except the labor cost of tools and the selling expenses. Likewise these tools and jigs are subject to a larger and more rapid depreciation than any other part of the equipment, but that is beside our question.

The cost of tools and jigs is ordinarily stated as the labor and material used. Often the material is not kept track of as being waste.

Let us see now what happens if it is found that the toolmaking force is overworked and a certain jig must be sent outside to be built. The independent builder of jigs has all the possibilities in the way of overhead charges and profits on his toolmaking that the first shop had on its regular product. Therefore, it is reasonable to expect that its bid will be at least double the cost of similar jigs built by the first shop as entered on their cost books. This being the case, it is natural that shop owners dislike to send jig work outside.

This is simply one more form of self-deception. The way accounts are entered in a book has no more to do with actual costs than has the question of whether the book has a red or a green cover. The fact remains that if the actual cost of the jig is found it will bear its share of the overhead charges, thereby lessening the overhead charge on all the manufactured product by a small amount.

When this actual cost of tool work is found it will be seen that unless a firm has a large enough amount of it to keep a large gang of toolmakers constantly busy, it cannot afford to make its own tools at all. Otherwise it is in exactly the same predicament that it would be if its regular product was seasonal, involv-

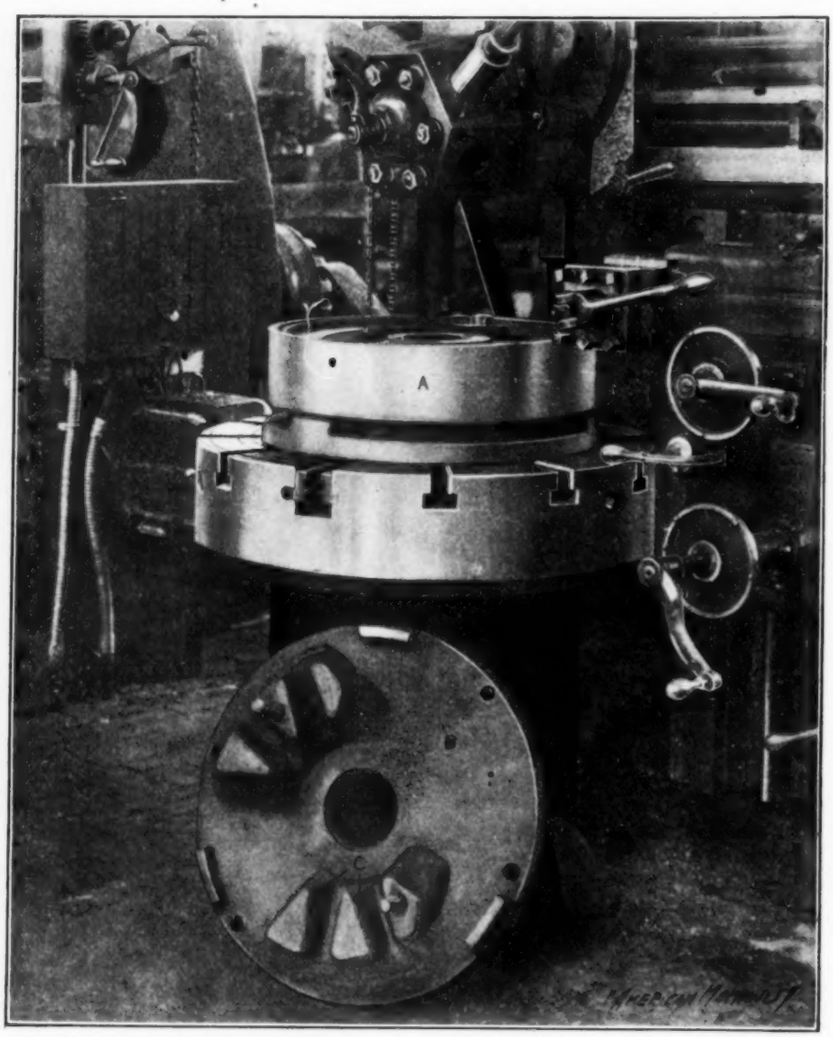


FIG. 4. BORING MILL AND FIXTURE USED IN MACHINING DRIVING WHEELS

ing the carrying of an expensive organization over repeated periods of slack times.

Taken all in all, it is as absurd for a machine-tool shop to manufacture its own tools as for all the machine shops of the country to enter upon the building of machine tools as they were needed.

A Mold Board and a Core Setter

The illustrations show two interesting molding appliances from the foundry of the Wheeler & Schebler Manufacturing Company, Indianapolis, Ind. Fig. 1 shows a mold board consisting of a cast-iron outer frame and an inner section of plaster of paris, carrying the pattern of some float-valve handles used in the carbureter. The reverse side of the mold board is a duplicate of the side shown, so that both sides of the mold can be rammed up and by simply removing the mold board the two parts of the mold are ready to be put together.

A somewhat similiar mold board is shown at the right in Fig. 2, while at the left is a core-setting plate which is said to save considerable time.

The cores can be set in one of these plates by any boy, and by turning the mold over the plate and then reversing it, the cores are accurately set in their correct position in the mold itself.

Testing Pitch of Micrometer Screws

BY H. L. WHITTEMORE

Upon a recent visit to the Alvan Clark & Sons' shops in Cambridge, Mass., where their famous astronomical telescopes are made, I was shown many very interesting features of the work by Carl A. R. Lundin and his son. Many of their methods and instruments are of the greatest precision and some most remarkable results have been achieved by their use. Some of them are used in the optical department while others have a wider field of application. Of particular interest is their method of making accurate micrometer screws for telescopes.

The screws which I saw were, perhaps,

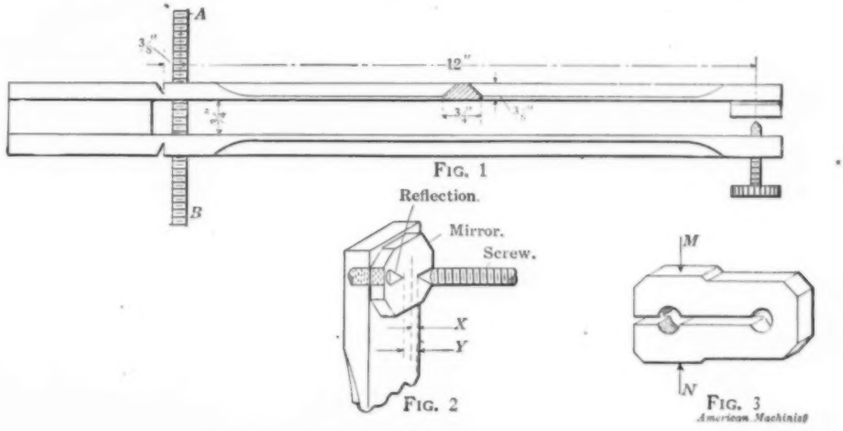
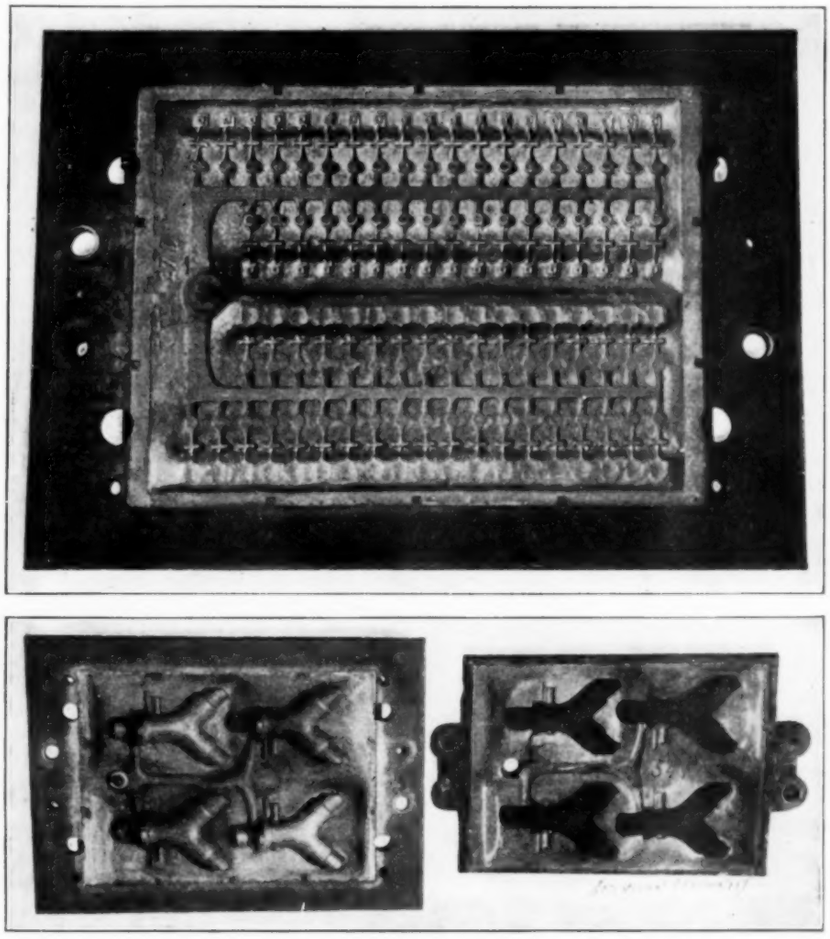


FIG. 1

FIG. 2

FIG. 3

TESTING PITCH OF MICROMETER SCREWS



FIGS. 1 AND 2. A PLASTER OF PARIS MOLD BOARD

two inches long and one-quarter inch in diameter. Instead of the usual V-thread having an angle of 60 degrees, they use one of 30 degrees, slightly rounded top and bottom. These are cut in a lathe with a circular-forming tool which is sharpened by grinding only the top face. Mr. Lundin spoke particularly of the difficulty of getting satisfactory tools which would complete a thread without sharpening.

After cutting, the screws are finished with a lead lap and fine emery. This makes them uniform in diameter and removes inequalities of pitch. The diameter of the screw is tested by means of the fixture shown in Fig. 3. It is made of brass and the slot closed slightly so as to hug the thread. Micrometer readings of the distance between the faces *M N* are taken at frequent intervals in the length of the screw.

The pitch is tested by means of the fixture shown in Fig. 1, which is made of wood and which, at first sight, seems almost crude. Its wonderful delicacy, however, will be appreciated upon second thought. The screw to be tested, *A B*, is threaded through both the arms. If the latter are pressed together a little when this is done, there will be a slight initial tension on the screw which will take up all slack in the threads. At their outer ends, one of the arms is provided with a pointed screw as shown and the other with a small mirror. Instead of the ordinary kind (having a silvered back), which is entirely unsuited for this work, this mirror reflects from the *front*

surface. It is a small piece of black glass fastened to the arm with a mixture of beeswax and rosin. Any dark-colored glass is said to answer and a perfectly plane surface is unnecessary.

This rig, having the dimensions shown in Fig. 1, multiplies any error in the screw about 33 times at the end of the arms. The mirror, which is an ingenious addition, then further multiplies the error twice without any mechanical complication. This is illustrated in Fig. 2. The actual distance of the screw point from the mirror is *X*, but its apparent distance from its reflection is *Y*. The screw point is adjusted as closely as possible to the mirror without touching it, and the screw *A B* rotated.

In making this test for uniformity of pitch, it is important to have a uniform diameter when completing the work. The two corrections are, I believe, carried on together.

When finished, each screw is tested and the graduations on the dial or thimble calibrated to suit the actual pitch which it is found to possess.

Inertia of Air Compressor Intake

By Snowden B. Redfield

An attempt to show, by applying the theory of inertia forces of reciprocating parts of an engine, that the distinct increase in air pressure at the end of intake stroke, often observed on air-compressor indicator diagrams, is due to inertia of the moving air column.

Possible application to practical purpose of materially increasing volumetric efficiency of compressor.

That the inertia of the pulsations of air entering a compressor cylinder, due to the reciprocating action of the piston, may cause an increase in the pressure of the air at the end of the suction stroke, appreciably above atmosphere, thereby increasing the volumetric efficiency of the cylinder, is a subject of considerable discussion among pneumatic engineers. Fig. 1 shows an air-compressor indicator diagram with this rise in intake pressure above the atmosphere line at the end of the suction strokes, *A A*; such diagrams often being found and by some mistakenly regarded as evidence of discharge-valve leakage.

It is quite generally admitted that, under favorable conditions of unobstructed piping, high piston speed and relatively large number of reciprocations, a water pump actually will deliver more water than its piston displacement would indicate. This is simply because the water attaining a high intake velocity, does not stop instantly when the piston reaches the end of its travel, but the inertia of the moving water tends to continue the flow during the instant of rest previous to reversal of piston stroke.

This sounds like "perpetual motion," but an instant's reflection will free the mind of such an impression. The speed and inertia given to the rapidly moving water must, of course, have come from the piston and this latter must have received them from the power of the driving mechanism, so that every extra foot-gallon of work done will be accounted for at the motor end of the machine.

Such conditions in a water pump could obtain only with relatively low heads because, water being incompressible, the energy of flow quickly would be absorbed in overcoming the pumping head as the water rushed directly through the pump cylinder into the discharge. This restriction would not hold, however, with moving air for, although the air is very much lighter and has much less inertia for a given volume, even at its higher speed, this inrushing air would not encounter the pressure of the discharge at all; but simply would crowd into the cylinder against a pressure approximately atmospheric, causing a slight increase of this pressure above the atmospheric line, as shown in Fig. 1.

If the inertia effect does take place, as the rise in the air-intake line would seem to show, to marked degree sometimes, what effect does it have, and can any practical steps be taken to improve the action of a compressor thereby? The effect of an increase in the pressure of the air just as the compression stroke commences, is materially to increase the volumetric efficiency of the cylinder; that is, to increase the amount of air compressed by a given sized cylinder. In these days of obtaining the finest points of economy, "every little bit helps" and if, by an inexpensive arrangement of piping, an increase of a few per cent. in volumetric efficiency may be obtained, this may be counted a material gain.

Basis of Calculation

This article is not intended to be a complete theoretical explanation of this phenomenon, but an attempt to point out in a more or less crude fashion, that there is a theoretical reason for accounting for its occurrence on the inertia basis. Probably some mathematical expert can figure it out much more directly and accurately.

As a basis for calculating such an effect of inertia we may turn to the method of calculating the inertia forces of the reciprocating parts of a steam engine. We may do this on the assumption that the motion of the air in the intake pipe is in a series of pulsations corresponding to the reciprocating motion of the air piston. Close to the compressor cylinder, this probably is very nearly true and the effect must be similar in a gradually decreasing degree at greater distances. Even at the further end of a compressor intake pipe of considerable length, these pulsations are distinctly noticeable by placing the hand in the current of air rushing into the pipe. Far enough away from the piston, the pulsation waves are, no doubt, distinctly modified from the approximately simple-harmonic motion of the piston, but the distance would have to be very great before the elasticity of the incoming air would be such as to absorb all pulsations and result in an even flow of air into the pipe.

Those who have studied the crank effort diagram of the steam engine, or other machine involving a crank and connecting rod, are aware that the starting and stopping forces at the ends of the strokes are, with an infinite connecting rod (or a "Scotch yoke"), equal to the centrifugal force that would be produced if all the reciprocating parts were revolving about the shaft at the radius of the crank circle. If the force at the end of the back stroke or beginning of the forward stroke, this force tending to produce tension in the rods, be considered positive; the stopping force at the other end of the stroke, tending to produce compression in the rods, must be considered negative.

At some time, then, during the stroke of the piston, the inertia forces must become zero, the parts having been completely accelerated and traveling along in equilibrium. With an infinite connecting rod (Scotch yoke), this point of zero inertia force occurs at mid-stroke, and a diagram of the forces of inertia of the parts would be as in Fig. 2. In this case, the forces at each dead center would be alike, and the point of zero force would be, as said, at mid-stroke.

In this reasoning the difference between *inertia* and *inertia force* must be distinctly appreciated. At mid-stroke the *inertia*, or stored energy would be maximum, due to the high velocity; but the *force* exerted would be zero, because there would be no acceleration or retardation. Toward the stroke ends, however, the slowing of the motion would

transform the *inertia* into an active *force* pressing on the crank pin and assisting the motion, this force becoming a maximum just at the instant of stopping. At this instant, of course, the *inertia* would be zero. Whatever force assists the crank pin toward the end of each stroke, correspondingly tends to retard the crank pin during the start of the next stroke, so no net work is done by these forces.

Effect of Connecting-rod Angularity

For the real conditions of a finite connecting rod, we may refer to some calculations by Professor Jacobus in the Transactions of the American Society of Mechanical Engineers, Volume 11, pages 492 and 1134. In these papers will be found a table of factors worked out, by which the theoretical, infinite-rod forces may be multiplied to obtain the actual, finite-rod forces. A plot of such a calculation will produce a curve like Fig. 3, where the forces at the two ends of the stroke are unlike and where the zero point is somewhere around 80 degrees of crank angle, measured from the head center. These changes are due simply to the effect of the connecting-rod angularity in putting the piston forward of

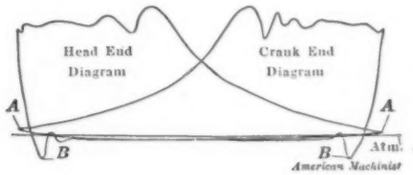


Fig. 1. Indicator Diagram from Low-pressure Cylinder of an Air Compressor, Showing Effect of Air Inertia

where it would be at any one time if the rod were infinite and had no angularity.

For an infinite rod, the force of inertia, in pounds, at any position of crank angle is expressed as follows:

$$F = \frac{W \pi^2 N^2 R}{900\, g} \quad cos.\ \theta,$$

where

W = Weight of reciprocating parts, in pounds;
N = Number of revolutions of crank per minute;
R = Crank radius, in feet;
g = Acceleration of gravity, 32.2;
θ = Crank angle, measured from head dead center.

When $\theta = 0$, $cos.\ \theta = 1$ and F becomes the same as the centrifugal force, as already explained, for the dead-center position.

From Professor Jacobus' figures, for a machine having a connecting rod of length equal to five times the crank arm, the usual design for air compressors, the force at beginning or end of either stroke, should be

$$F = \frac{W \pi^2 N^2 R}{900\, g} (cos.\ \theta + 0.2).$$

Application to Moving Column of Air

To apply this formula to a moving column of air in a pipe, W will be the weight of air in motion, N will be the number of double reciprocations corresponding to the revolutions of the compressor crank, but the value of R will not be the crank radius. This will be understood from the fact that, due to the intake pipe being much smaller in area than the air cylinder, the air in this pipe must travel faster and further at each stroke than the piston does. Suppose the intake pipe area is approximately 12 per cent., or ⅛ of the piston area. Then, at any given time, the air must be traveling 8 times as fast as the piston and, in order to fill the cylinder, the requisite air will have to travel 8 times as far in the pipe as the piston does in the cylinder. In other words, the air pulsations are 8 times as long as the piston stroke, and consequently, in this case the value of R in the formula for the air must be 8 times the length of the compressor crank arm.

As might be expected, the formula shows that the inertia force is proportional to the square of the number of revolutions. This means that the greater the number of stops and starts in a given time, the greater the forces. Consequently a relatively short stroke with a given piston speed is conducive to heavy forces.

An Example

To take a specific example: Suppose we have a 36-inch stroke air compressor, running at a speed of 100 revolutions per minute, a practical figure for modern, high-speed practice, especially for direct-connected electric drive with motor on compressor shaft. Let the cylinder be 34 inches diameter and let its average net area be 900 square inches. The intake pipe area, being ⅛ of this, let its inside diameter be 12 inches, with actual area of 113 square inches. The ratio of cylinder and pipe areas then will be 8 to 1, and so the air speed and length of air pulsation will be 8 times as great as those of the piston.

Let us say that the intake pipe is 25 feet long, from entrance at outside of building to cylinder; let the temperature of the air be 60 degrees Fahrenheit. At the instant of stoppage, the air in the inner end of the pipe will be compressed by the inertia to some pressure above the atmosphere, while that at the outer end will be atmospheric and only that in the middle section will be, say, half a pound below atmosphere. It then will be reasonable to assume that the average pressure of all the air is atmospheric at the instant of stoppage and greatest force and pressure. The weight of the air contained in the pipe then must be 0.0764 pounds per cubic foot, and as the volume of the pipe of 12 inches inside diameter and 25 feet length is 19.6 cubic feet, the total weight of air flowing in the pipe at this instant will be 1.50 pounds.

Taking, first, the force at the head center, we have, by applying the formula already given for a five-crank length connecting rod;

$$F = \frac{1.50 \pi^2 100^2 \times 1.5 \times 8 \times 1.2}{900\, g}.$$

In this expression, the factor 1.5 is, of course, the crank radius in feet, and the factor 8 is the ratio of cylinder area to intake pipe area and, consequently, the ratio of air pulsation length to piston stroke; so that the product of these two factors represents the imaginary length of crank arm that would produce the air pulsations occurring in the intake pipe. The factor 1.2 is the sum of the cosine of 0 degrees (unity), the crank angle at head dead center, and the factor 0.2, calculated by Professor Jacobus for the connecting-rod length chosen.

The solution of the expression given above is:

$$F = 73.5 \text{ pounds.}$$

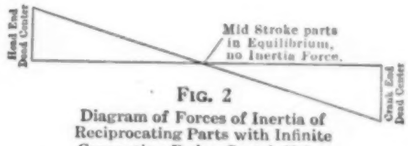


Fig. 2
Diagram of Forces of Inertia of Reciprocating Parts with Infinite Connecting Rod or Scotch Yoke.

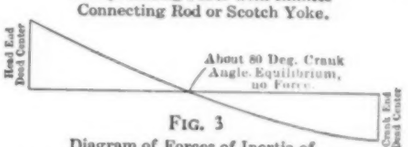


Fig. 3
Diagram of Forces of Inertia of Reciprocating Parts with Connecting Rod Length of 5 times the Crank Arm.
American Machinist

Inertia Forces Due to Reciprocation

This is the total pressure exerted in stopping the column of air at the end of the suction stroke at the head dead center, but it must be remembered that, if the air passage is continuously of the same area, 113 square inches, this pressure will be distributed over this whole area and so the pressure per square inch exerted will be $\frac{73.5}{113} = 0.650$, or over ⅝ of a pound.

Cumulative Effect

Just at this point we should consider a further inertia effect; the "piling up" and compressing of the air in the cylinder and the inner portion of the intake pipe. The result of such an action would be to allow the remainder of the air in the pipe to continue flowing and crowding in, so that the actual length of air pulsation is greater than we have assumed. The effect of increasing this pulsation length is to increase the value of R in the formula, and thus further increase the force which we are endeavoring to calculate. The logic is that, the number of pulsations per minute remaining the same, the

stopping force must be greater if the distance traveled, and consequently the linear speed, is greater; also the additional air entering the pipe adds its inertia to the effect.

As this would tend further to increase the pressure, let us assume that the final pressure would be, say, 0.7 pound above atmosphere, or 15.4 pounds absolute. Now, the volume of the compressing cylinder is 18.7 cubic feet and, as an estimate, we may include the last 6 feet of intake pipe in this "piling up" effect. This gives a total volume of 23.4 cubic feet into which the incoming air is crowded from an initial pressure of 14.7 to 15.4 pounds. Then this 23.4 cubic feet of air will occupy a space of $23.4 \times \frac{14.7}{15.4} = 22.3$ cubic feet, thus leaving $23.4 - 22.3 = 1.1$ cubic feet of the last part of the pipe for more air to crowd into. With a 12-inch intake pipe this means a length of 1.4 feet, and this length is to be added to the value of R, or imaginary radius of pulsation wave. As the old value of R was $8 \times 1\frac{1}{2} = 12$, we now have 13.4 feet for the more probable value of R.

As the value of F is directly proportional to R, the more probable value of F now will be

$$0.650 \times \frac{13.4}{12} = 0.726 \text{ pounds},$$

giving a final intake air pressure of over 15.4 pounds per square inch absolute, which agrees with our assumption when we began to consider this "piling up" effect. It is, therefore, reasonable to assume that there would be, under the circumstances of this case, an initial air pressure just at commencement of compression, of 0.726, or nearly ¾ of a pound above atmosphere. This would increase the volumetric efficiency by quite 5 per cent., a result well worth striving for.

Forces Unequal at Head and Crank

At the crank end of the stroke, the force would be somewhat less, as the value of *cos.* θ would be -1, and $-1 + 0.2 = -0.8$. This would then make the pressure at the crank end about 0.484, or a little less than ½ pound per square inch above atmosphere, increasing the volumetric efficiency at this end by over 3 per cent. The average efficiency increase for the two ends then would range about 4 per cent.

This condition of unequal effects at the two ends is borne out in practice, for an examination of the indicator diagrams containing these inertia effects invariably shows more initial pressure at one end that at the other.

To be strictly logical, the increased quantity of air admitted to the outer end of the pipe by the crowding and compressing of that at the inner end, should be taken into account. This increase was shown to be 1.1 cubic feet, bringing the weight up to 1.58 pounds. This would further increase the head end inertia force to $\frac{1.58}{1.5} \times 0.726 = 0.765$ pound per square inch, or over ¾ of a pound pressure; and the crank-end force to 0.51, or over ½ pound per square inch. This would tend to show that we are at least on the conservative side, leaving room for pipe friction and other losses.

Practical Considerations

From the foregoing, it would appear that a longer intake pipe would contain more air in motion, and so would give an increased inertia force and higher volumetric efficiency. Double the length of pipe would give double the weight of air; but, as before intimated, the pulsations probably are modified considerably at the end of so long a pipe. Another matter too, is the loss of pressure by friction through this long pipe, but this is really negligible if the air speed is kept down around 4800 feet per minute. As an example, tables worked out in Kent, from B. F. Sturtevant Company's formulas, show that the loss of pressure through 25 feet of 12-inch pipe, with a speed of 4800 feet per minute, is about ½ ounce.

It may well be asked "why should the pipe produce this inertia effect any more than if the air flowed directly from the atmosphere into the cylinder, thus avoiding even the small friction of flow. The answer is that the air in the pipe has a smooth flow and has an opportunity to attain the velocity calculated; whereas, if the pipe were absent, the atmospheric air would flow from all sides at low speed and furthermore, all energy of motion would be lost in eddying at entrance. The pipe keeps the air flowing straight, swiftly and without eddying to any great extent.

Some persons will realize that this force or pressure required to stop the incoming air at the end of the stroke must be balanced by an equal and opposite inertia force required to *start* the pulsation at the beginning of the stroke. No better evidence of this can be desired than the ever present "hooks" *B B*, Fig. 1, on all air-compressor indicator diagrams. Two excuses usually are given for these; inertia of indicator parts dropping from the pressure of discharge to that of intake, and the pressure required to open poppet valves. The first excuse seems inadequate with a modern, light indicator and as to valve resistance, the writer has seen these "hooks" with Corliss inlet valves open wide before the stroke started.

It will be well to add that an actual case of this kind; but which, owing to several elbows and a strainer in the intake pipe, it was impossible to figure upon intelligently; recently has been brought to the writer's attention, where the initial pressure of the intake line is about 1½ pounds above atmosphere at one end and 1 pound at the other.

50 Years in the Steam Pump Business

By an Old Timer

The memory of the little world in which old-time apprentices lived makes them seem a class or species of a distinctly separate creation. One of the devices to allure them into the right path and make them useful members of society (and the shop) was to hold out the promise that in the future they might become foremen, or even bosses. This was very much like the hints that schoolboys get from their teachers, that each and every one stands a good chance to become President of the United States; for was not every President once a schoolboy?

Never mind the defiance of the cold and sullen fact that while every President had been a schoolboy only a very fed schoolboys become Presidents, showing that the supply of republics is limited and that there are not enough of them to go around.

While an apprentice may have faith, he knows when it borders upon credulity, and that is not the "strong holt" of his mind. They had enough hard work to fill up their time chock-a-block except when the foreman's eye was not on them, and then—well—they squared the account conscientiously.

Sixty years ago, in the time of the old shop, Twenty-eighth street, New York, was the limit of dwellings or any kind of buildings. I had to walk from there to the Houston Street ferry and a mile further in Williamsburgh. Six miles per day for a round trip—horse cars were unknown.

In 1849-50 the Collins Line steamers of 3000 tons, famous for being a departure in size and design, were built close to the foot of Houston street. The older projecting bow, with ornate figure head was replaced by a bow that was nearly vertical, only slightly inclined forward. All semblance to a sailing ship was abandoned. The masts and sails were only sufficient to bring her head to the wind in case of emergency. These steamers were adversely criticized by all foreign shipbuilders, but shortly after they were copied and improved upon along the same lines of construction. They were wooden vessels with the timbers braced with a lattice every five or six inches of 1-inch bars of iron bolted diagonally to the timbers. They were side wheelers, of course, with iron framed wheels and wooden buckets.

First Independent Worthington Pump on a Steamer

The ocean-going steamer "Washington" was, with the exception of her

wheel houses, like any other old-fashioned full-rigged ship and had on board the first Washington independent steam pump for bilge and fire purposes, washing decks and spare boiler feed.

The steamer's boilers were limited to 25 pounds pressure, the engines were of old fashioned side-lever design and filled up about one-third of the ship.

The Worthington pump cylinder had the first rubber-disk valves ever used. The pump had a 16-inch steam cylinder and a 10¼-inch plunger and ring, solid fitted, no packing, with 9-inch stroke. There were nine valves in each chamber, in size 3x½x9/16-inch hole in center, and being first of their kind were cut out of sheet rubber with a cutter fixed in a carpenter's brace and bit.

These are standard to this day and are molded by the rubber companies for all steam-pump manufacturers.

To turn back a little to consider the water-valve question: All pumps, whether attached or independent, had been provided with only one metal valve to each chamber. Mr. Worthington had followed that method and had made all his earlier pumps with an oblong flat metal valve that covered a part like that on a steam-chest face, and rocked open and shut on a sort of half hinge or heel, governed by a spring of brass, something like a wagon spring. A small obstruction under the heel of this valve would throw that end of the pump out of commission and the attendant into fits.

The demands of marine service, particularly for bilge pumping, called for improvement. The steamer "Washington's" pumps were especially designed by Mr. Worthington to alleviate this trouble as it was quite common to find bits of wood, scraps of leather and rubber and sometimes a fireman's cap and overalls in the suction chamber.

The multiple valve scored a great success, as the valve plates acted as a coarse strainer, and all the débris that came up from the bottom of the ship stopped in the large suction chamber, and could be removed from time to time by taking off a hand-hole plate, when the pump showed signs of strangulating.

The ancient abomination of a strainer on the lower end of a suction pipe could no longer be endured on shipboard, still, an accessible strainer was desirable. This led Mr. Worthington to invent the side pipe attached to one side of the pump suction chamber with a coarse-mesh wire cloth basket suspended inside. The water flowed into the inside of the basket on its way to the pump to avoid collapse and when the basket was full it was quickly removed by opening the hinged bonnet on the top of the side pipe. The strainer was replaced by a spare one, the other was emptied, cleaned and sometimes dried or burned out in the furnace door-way ready for the next choking up of the suction. The extreme simplicity of the relief-valve motion found favor rapidly with the public.

Previous to this Mr. Worthington had tried every known form of steam-valve motion and some mechanical valve motions, where the power to drive the steam valve was stored up during the first part of the stroke and released near the end.

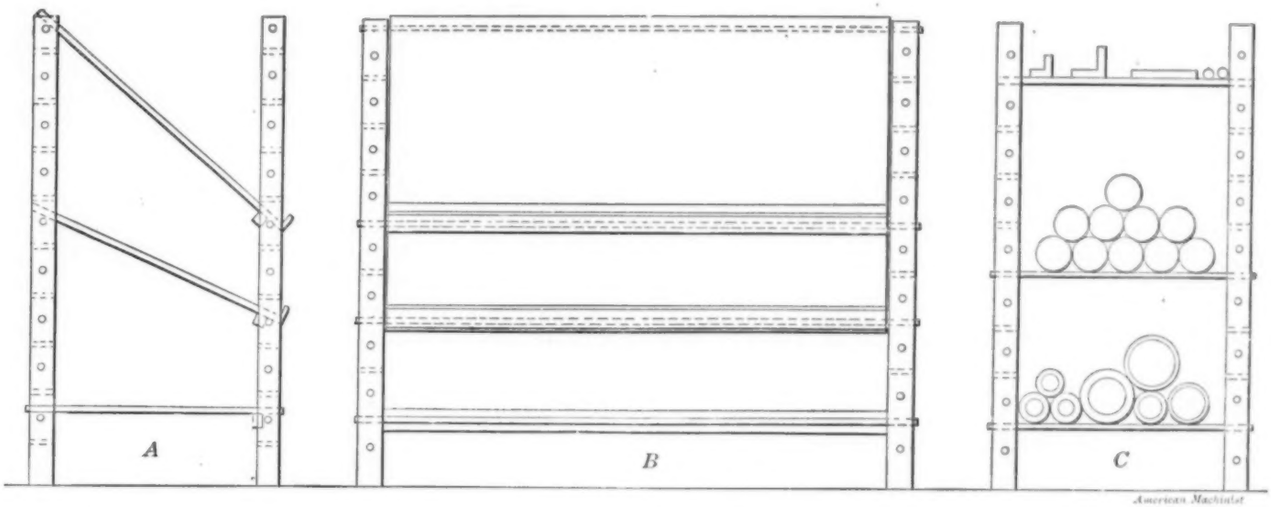
The relief motion was obtained by drilling a ring of holes in the plunger on each side of the diaphragm, which allowed the water on the forcing side of the plunger to escape to the suction side the moment the holes passed the ring. This gave a sudden impulse to the piston by the release of the load, and the arm attached to the piston rod striking at the same instant the tappet on the valve rod threw the steam slide valve. The entering steam prevented the piston from striking the cylinder head.

This pump held its own in the market long after the patent had been renewed and expired, and even now one or two occasionally turn up for repairs after 40 years of use.

A Neat Tool or Stock Rack

A very neat tool or stock rack was recently found in the Bridgeport Trade School, having been introduced by A. L. Graffam, the instructor in machine-shop work. The rack consists primarily of square uprights of about 3-inch section, having ⅝-inch holes drilled about 4 inches apart. These holes are drilled in opposite directions, so as to miss each other, as can be seen by the full and dotted lines.

These uprights can be spaced any desired distance apart, and in the case of tool shelves, as shown at *A* and *B*, these rods run parallel with the shelves. The view at *A* shows how the shelf can be either horizontal or inclined to any desired angle, a cleat on the under side resting against the front rod and this preventing its slipping.



HANDY TOOL AND STOCK RACK

These can be strung along in as many sections as desired, corners turned at will, and the plan will be found very flexible in every way.

They can also be easily used for stock, as seen at *C*. In this case the rods are run crossways, and angles, bars, rounds, or tubes can be held as desired. This makes one of the most flexible and convenient racks we have seen.

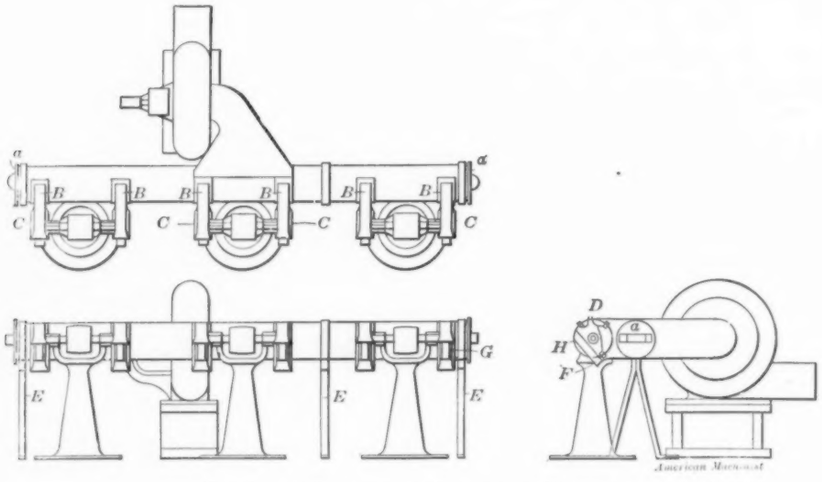
There is one special machine-shop tool used in some parts of India that is unknown in this country. It is a long-handled wooden tongs used to catch obstreperous cobras and toss them in a boiler furnace, or some other place where they will do no harm.

Making a Polishing Stand

By C. A. Rogers

I had six polishing wheels that had the usual habit of making life a burden for everyone in the shop, besides the damage to other machinery by the dust. So I thought I would install an exhauster of some kind to carry away the dust. How large should it and the piping be? I consulted the catalogs, but found nothing; called in my friends with the same result; waited until my traveling friends came along, but they only looked wise and then finally admitted that they knew more about blowing than exhausting.

A mechanical engineer—a graduate from a mighty good school, came in and finally told me he would have to consult some authority. I haven't seen him since. I went through my files of American Machinist, and while there was a little information there, it didn't suit my case very well. So I went ahead on my own hook and the results are so pleasant I thought perhaps someone else might be in the same fix and profit by my experience.



Plan for Building a Polishing Machine

The Work to be Done

I have steel plates, ¼ inch thick, 9 inches wide, 26 inches long, to polish on one side. One of the stands is fitted with an alundum wheel 2x12 inches, 1800 revolutions per minute, and on this one the scale is just ground off. The plates are passed to wheels No. 2, which are 2x12 inches cotton tufts, just a coating of a good quality of glue, costing about 14 cents per pound by the barrel. The 24-grain alundum is placed in a pan about 4 inches wide, 4 inches deep and 24 inches long, about ¼ inch deep on the bottom. The pan is then placed on a fire and heated to just a little warmer than the glue, and the wheel with the glue on it rolled back and forth under a slight pressure until the glue has taken up all it can. It is then laid away at least four hours to cure. This wheel will then last about three or four hours.

After the plates are polished on this wheel they are passed to the finishing wheel which is also a stitched tuft, exactly the same as No. 2, except as to the material used to charge it, which is the heavy dust from wheel No. 2, which falls to the floor, mixed with (after sifting) 10 per cent. No. 120 grain emery.

How it is Arranged

The arrangement of the plan is shown in the sketch sent herewith.

A No. 4 Buffalo exhauster was guessed at as being the right size to carry off the heavy dust. It will be noticed that it is set up on a level with the center line of the polishing wheels and in the center endwise, so that the dust would not have to travel down and as short a distance as possible.

The exhauster has a 9-inch opening and runs 2000 revolutions per minute. The piping is 12 inches in diameter and set up close to the hole so that the wheels pass within one inch of the main pipe. The hoods and their shape, which is the most important detail are as follows: Barely clearing the buffing wheel at *H*, ⅜ inch clearance at *G*, and 2½ inches clearance at *F*. They are curved out about 1½ inches, as shown. The cover or frame at *C*, which is part of the hood, has to be taken off to change wheels and is held in place by the friction clips *D*. The end caps *A* are made removable for cleaning purposes. The supports *E* are fastened to the door and hold the piping in place, so that the constant jar of the wheels will not disturb it. Just enough of the wheels project from the hoods so they can be used. This system carries away the dust so well that this is one of the cleanest places in the shop and it is easy to get men to work at the polishing, which is no small item.

In setting the job up, tight and loose pulleys were dispensed with. A jack shaft was placed on the floor above, running 600 revolutions per minute. Belts are thrown off and on to change the wheels and is a safe and easy job when a man gets used to it. The cost was: Exhauster, $33; piping, $25; total, $58.

Parallel Boring on the Lathe

By J. H. Rodgers

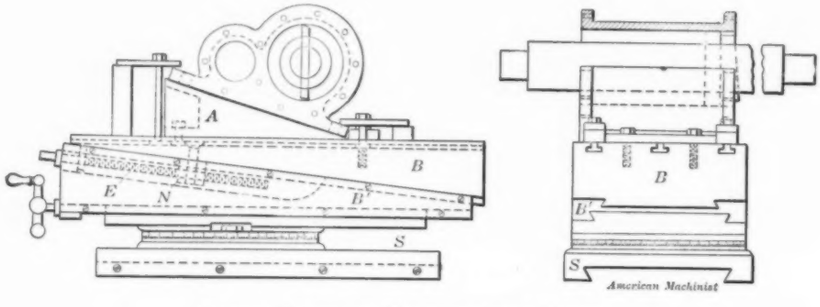
The line cut shows an attachment for boring castings having two or more cylindrical holes, the axes of which are parallel and in the same plane.

The compound rest is removed from the cross slide *S*, and the attachment placed on and secured with bolts similar to the compound rest.

The tapered block *A* is planed to an angle so as to bring the center line of the cylinders as near horizontal as possible. Any error of adjustment in vertical setting can be taken up by moving the block *B* along the block *B'* with the screw *E*, the nut *N* being secured to the table block *B*. By the use of the graduations the table can be moved to any desired angle in the horizontal plane.

By the use of small center heads (similar to those on a milling machine) and other jigs, many small jobs often met with in a small repair shop can be successfully handled.

By lifting the lower block *B'* directly to the saddle, in place of the slide *S*, the attachment could be made much heavier for larger work.



Boring Parallel Holes on the Lathe

Factory Construction for Offices

Editorial Correspondence

An adaptation of factory design and construction for a large shop office building. Concrete is the principal material of construction. There is an abundance of light and air.

The Fore River Shipbuilding Company, Quincy, Mass., has recently completed a large office building containing nearly 40,000 square feet of floor area. This building is worthy of study for two major reasons. Its form of construction is a factory type, having a concrete frame, wooden floors and side walls of glass; and it is the first building of any size built according to the Wilson system of mill and factory construction. This system has been developed and patented by Francis W. Wilson, consulting engineer, of Boston, Mass., who was the architect and engineer employed by the Fore River firm.

Fig. 1 shows us the building. It is seen to be simple in design, with very little exterior ornamentation. Some 45 per cent. of the side walls are glass. In the rear of the building at the right of the illustration is seen a solid brick vault used for the storage of valuable records, drawings and the like. On the roof will be seen the bottom of a steel structure carrying the aërial for the wireless telegraph service. Projecting outward from the windows of the fourth floor will be noted several frames used for sun blueprinting.

Type of Construction

Figs. 2, 3 and 4 show the type of construction used in this building and known as the Wilson system. It is seen to consist of a reinforced-concrete frame; that is, exterior and interior columns, beams and girders. As part of each T-shaped beam and girder are wooden side spiking strips or planks, set in place before the concrete is poured into the forms for the beams and girders, and in fact forming a part of these forms. These planks project a little distance above the tops of the beams and girders, and the space thus formed is filled with cinder concrete before laying the wooden floor. The floor is intended to have its bearing on the concrete filling and not upon the spiking strips. This floor detail is clearly shown in Fig. 4.

The side walls are composed of a curtain wall, carried direct upon the exterior girders, and wooden window frames and sash filling the space between the top of the curtain wall, the lower side of the exterior girder above and the exterior columns at the sides.

The reinforcement in the columns is composed of plain, round steel bars, as seen in Fig. 3, laced with 5/16-inch round rods.

The girders and beams are of T-sec-

Fig. 1. New Office Building of the Fore River Shipbuilding Company

Fig. 2. Concrete Frame of the Building

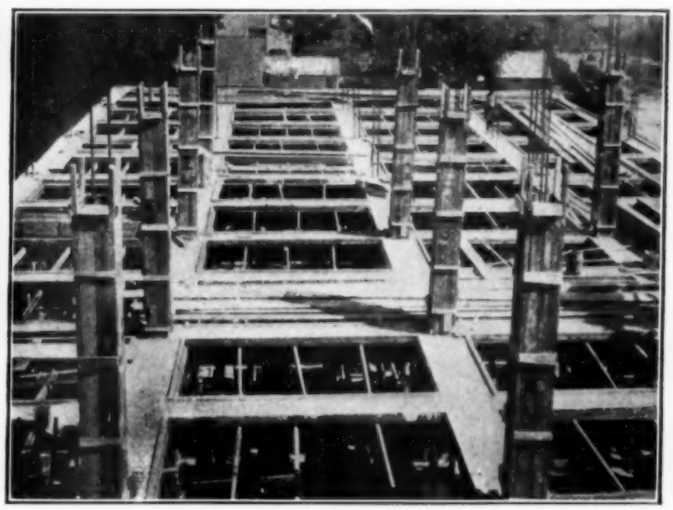


Fig. 3. Floor Girders and Beams, Column Forms and Column Reinforcement

tion, and the reinforcing is by means of flat bars built up into a truss, with short pieces of angle iron forming the anchorage for the ends of the bars that are bent upward to resist the shearing stress in the concrete members. Fig. 5 shows one of these built-up, reinforcing trusses ready to be inserted into a girder form. The angle-iron anchors are plainly shown, as well as the bent up ends of the lower bars, which serve to anchor the steel in the concrete.

Mr. Wilson has conducted numerous experiments in order to determine the strength of beams and girders reinforced according to this system, and believes that it is one of the most inexpensive forms of concrete construction that has ever been devised. The bars themselves are not corrugated nor twisted, nor otherwise arranged to hold mechanically in the concrete; but on the contrary they are ordinary flat steel bars such as can be purchased in the open market, of such sizes that they are easily bent into the required shape and readily built up into the required form as seen in Fig. 5.

The spiking pieces are fastened to the beams and girders by means of bolts passing through gas-pipe sleeves, all of which are placed in the forms before the concrete is poured. The beams may be spaced at any convenient distance apart—say 8 or 10 feet. A reinforced-concrete floor may be used instead of wood, as here shown and described.

In the office building at Fore River the floors are of 3-inch splined hard-pine plank covered with a ⅞-inch matched maple overlay. The roof is of 5-ply tar and gravel, laid on 2-inch matched hard-pine planks.

The first floor of the building is devoted to the general offices and is, therefore, cut up by numerous partitions. These partitions are of wooden studding covered with plaster board and three-coat work on each side. The decoration is a water-color paint of a pleasing yellow tint.

As we have mentioned, the window frames are of wood hung with wooden sash. A glance at the building shows that there are three windows in each group. The middle window is double hung, with a fixed transom above. Each side window is fixed with a swinging transom above. The lower half of all windows on all floors are glazed with ribbed glass, and the upper half with clear glass. This is found to give a very pleasing lighting effect, in addition to being of real value on the lower floor by preventing the distraction of persons and objects passing the office windows.

We have mentioned that the lower floor is devoted to the general offices, and a word in regard to their equipment is of value. Fig. 6 shows a corner of the president's room, and Fig. 7, a portion of the correspondence room. The standing finish throughout is of chestnut, stained to a pleasing yellowish green color. A special room is provided for the telephone and telegraph operator near the entrance door, and in addition to the regular Western Union service, United wireless service is about to be established.

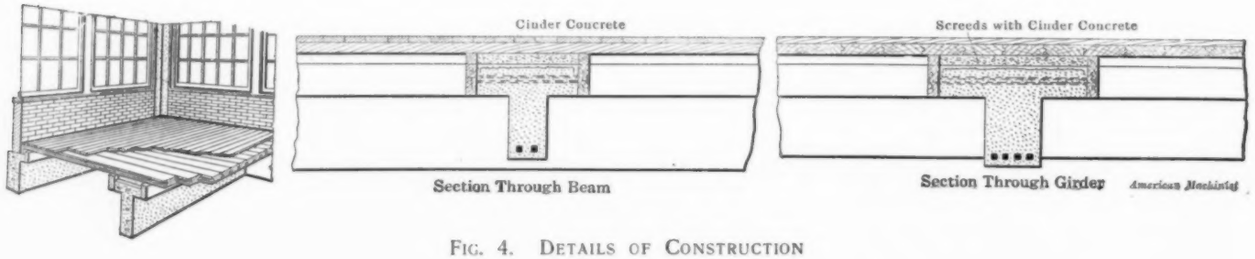


FIG. 4. DETAILS OF CONSTRUCTION

FIG. 5. A TYPICAL GIRDER REINFORCEMENT

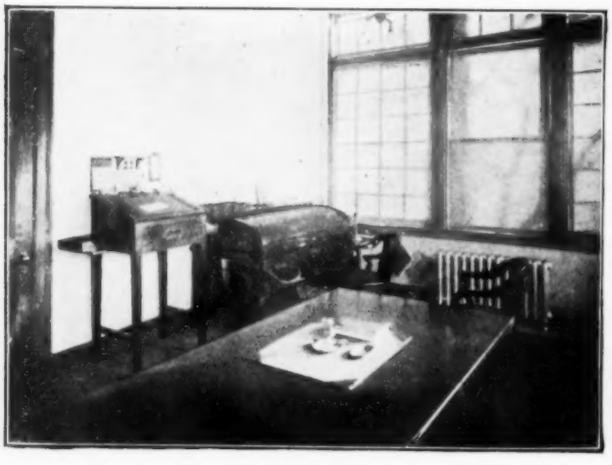


FIG. 6. A CORNER OF THE PRESIDENT'S OFFICE

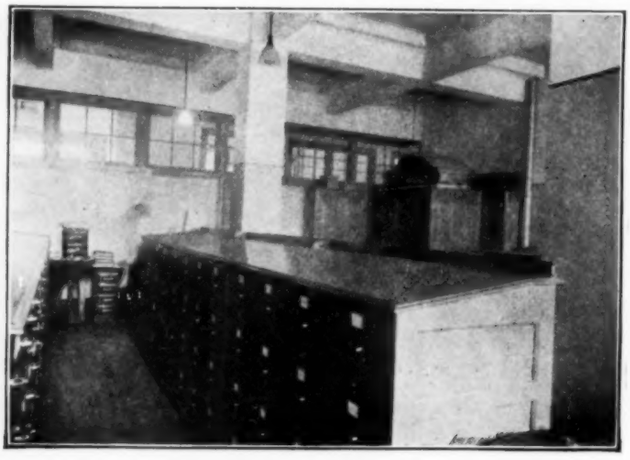


FIG. 7. THE CORRESPONDENCE ROOM

Figs. 6 and 7 show the general scheme of partitions, electric lighting and interior decorations.

Special rooms are provided for the paymaster, cashier, bookkeepers and executive officers of the company.

In addition to the use of chestnut for the standing finish, a great deal of the office furniture has been made at the yard, and this is also of chestnut. These are in the nature of movable racks, coat closets, cabinets, shelving and the like, all finished to correspond with the trim of the building. The effect is very pleasing, and undoubtedly the cost has been far lower than the price of similar articles purchased in the open market, for all of the woodwork has been done in the joiner shops of the yard.

The heating system is by steam from a set of boilers located in the basement; otherwise, the basement is only used for storage purposes.

A small wing projecting from the rear of the building contains the toilet facilities for each floor, and also forms a passageway to the brick storage vault previously mentioned. This wing furthermore contains the stairway, as the building is not provided with an elevator.

The second floor of the building is devoted to the hull drawing room; the third floor to the engine and electrical drawing room, and the fourth floor the blueprinting department. A certain part of the fourth floor is at present unoccupied, being reserved for future growth.

Two drawing-room views can be seen in Figs. 8 and 9. A study of Fig. 8 will show the excellent light, even in the center of the room. The interior effect, though plain, is pleasing. The ceiling and columns are all painted white, thus diffusing the light to the best advantage. It is as pleasant a drawing room as I have ever seen.

The electric lighting is by means of 45-watt tungsten lamps, suspended by adjustable drop cords. Six of these lights are provided in each bay. The arrangement is plainly shown. In fact, broadening the proposition, the lighting throughout the entire building is by means of these 45-watt tungsten lamps.

Figs. 10 and 11 show two corners of the blueprinting and photographing departments, Fig. 10 having in the foreground the blueprint washing tanks and drying racks, and in the back the electric printing machines. Fig. 11 shows the outfit for printing by means of the black-on-white gelatin process, a process recently introduced into this country from Italy and described a few weeks ago in our columns.

Unit Costs

The important tests for any construction are first its adaptability for the purpose intended, and second its cost. The reader can judge of the adaptability of this factory type of construction for an office building by the numerous illustrations in this article, and the following figures will show that the unit costs are right.

The unit costs for the completed shell, based on the best bids which were received, are 63 cents per square foot of floor area, or 4.55 cents per cubic foot of room volume. This includes the foundations, exterior walls, roof, floors, etc.

Again, on the basis of the best original bids, the unit costs for the building completed and equipped, that is with the lighting, heating and toilet arrangement installed, with all partitions set and with the building ready for occupancy, are $1.30 per square foot of floor area, or 9.2 cents per cubic foot of volume.

Fig. 8. The Engine Drawing Room

Fig. 9. A Corner of Electrical Drawing Room

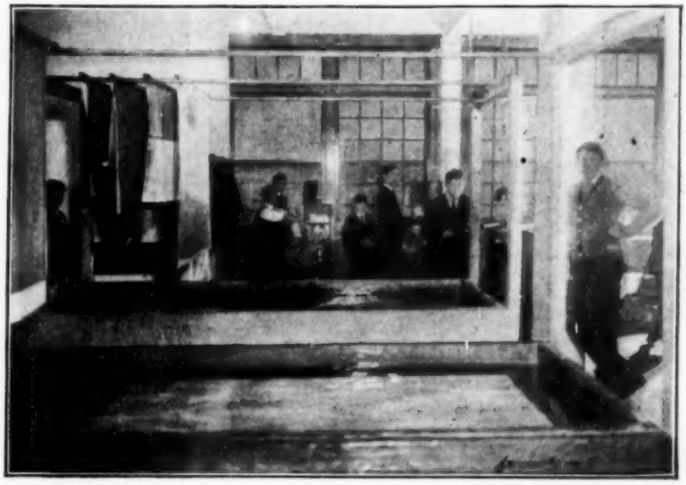


Fig. 10. Blueprinting Machines and Print-washing Tanks

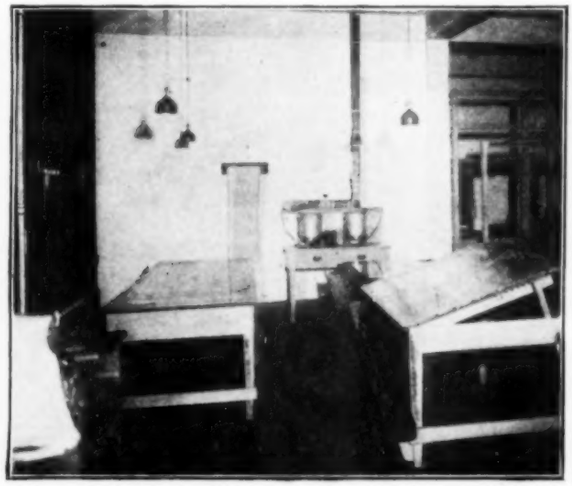


Fig. 11. Plant for Making "Black-on-white" Prints

As a matter of fact, the cost of the building was somewhat in excess of these unit figures, as certain changes were made in the specifications upon which the bids were invited before construction was actually commenced.

We are glad to acknowledge the courtesy of the Fore River Shipbuilding Company, and of Mr. Wilson, for the photographs and information upon which this article is based. L. P. A.

Time Saving Scheme for Handling Blueprints

By J. C. Spence*

The care of shop drawings and blueprints becomes quite a problem in the ordinary machine shop, where there are a great many different parts to be made and a number of operations on each part.

We have gone through the various makeshifts of letting the foreman have a cabinet which will hold all of the drawings required on his job; of having all of the blueprints at one central place, as at the inspector's headquarters or in the drawing room or tool vault, etc. There are two faults with all of these plans; namely, it takes an average of five minutes for a workman to get the right drawing from a central depot; when changes are made on a drawing, it is almost impossible to locate every blueprint that is to be changed and the chances seem to be greatly in favor of that missing print being used, later on, in the making of a future lot of parts. This condition invariably leads to trouble.

After becoming thoroughly disgusted with all attempts to check out blueprints and to keep them in good physical condition, we hit upon the plan herewith illustrated. Instead of the ordinary work tag, which usually goes along with the work, we use a strong envelop, 5½x7½ inches, see Fig. 1. This envelop is made out by the cost department to take care of an order for a certain quantity of pieces to be made for stock. The envelop is then sent to the drafting room, where the proper blueprint is inserted. By this means we are sure to get uptodate blueprints into the shop.

The envelop containing the blueprint is then sent to the storekeeper who, if he has the material on hand, marks the weight of material on the envelop, makes the necessary book charges and delivers the envelop to the shop superintendent. The fact that the weight is marked on shows the superintendent that the material is on hand, at his disposal. A 3x5-inch blueprint is clipped to the drawing, which small print shows the premium time and also gives the jig to be used in a given operation. This blueprint slip is shown in Fig. 2.

The envelop is then filed, in a "post office," under the heading of the mechanism to which the piece belongs and is now ready for the foreman who performs the first operation. The foremen look over this "post office," from time to time, in order to pick out such parts as they need to meet production requirements.

The envelop, to a great extent, protects the blueprint from dirt, and we constantly try to instill into the men the necessity of keeping both envelop and drawing in good condition. In order to enforce the keeping of the envelop and drawing with the parts to which they belong, we have two shop rules. One is that a time clerk will not write an operation time card unless he is shown the envelop; the other is that the inspector will not pass work along to the next operation, unless it is accompanied by both envelop and blueprint.

When the prices are completed and ready to be delivered to the stores department, an inspector takes the blueprint to the drawing room, where it is filed and is used over and over again until either disfigured or obsolete.

This method is practically sure to get the prints back to headquarters and also makes shop changes easy, as the record of unfilled orders tells at once just how many prints of a certain kind are in the shop and the record of operations shows who had these prints last.

NAME	T.D. Hand Gear Bracket		PART 4032
OPERATION	Pl. Gr.	JIG. NO.	PREM.
Mill complete		21	12
Drill & Pin			4
Dr. Rm. Tap		40	15
C'bore (4 holes)			3

American Machinist

Fig. 2. Small Blueprint Clipped to Blueprint of Drawing; Filled in on Small Tracing with Typewriter

A noteworthy tendency of the times is the favorable attitude of many manufacturers toward compensation for injured employees. This is particularly noticeable in New Jersey at the present time, where several well known manufacturers, among them the American Locomotive Company, the United States Steel Corporation, and the New Jersey Manufacturers' Association, have openly favored the Edge bill, which is now before the legislature of that State.

*Superintendent, Norton Grinding Company.

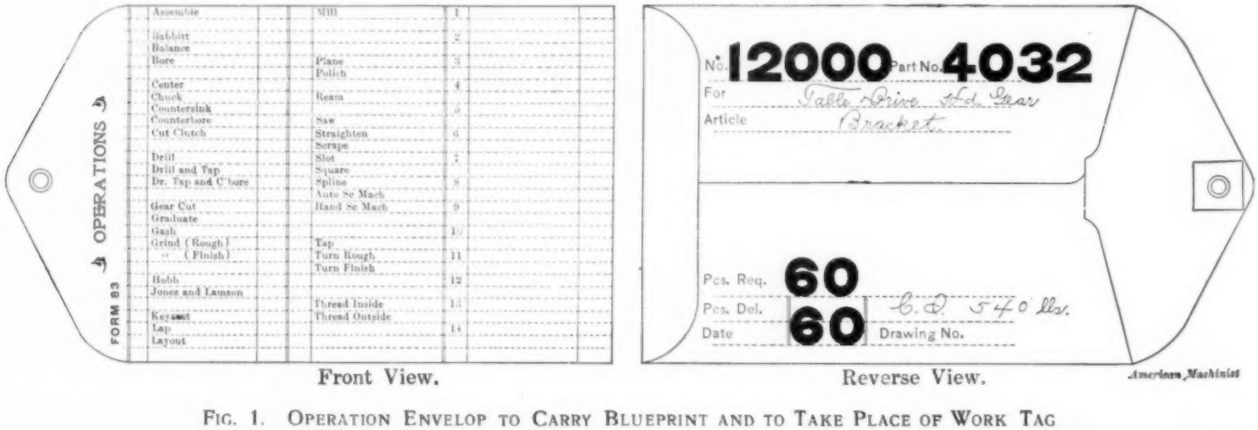


Fig. 1. Operation Envelop to Carry Blueprint and to Take Place of Work Tag

Dimensions of Cylindrical Shells*

By Otto S. Beyer†

A collection of charts connecting the diameter of the blank, the diameter of the shell and the hight of the shell by which all usual problems involving these dimensions in drawpress work may be quickly solved without mathematics.

These charts are a new contribution to the art and are of direct application to every day problems.

Thorough knowledge of the mathematics relating to sheet-metal shells, whether round or irregular in shape, or cylindrical, or tapering of body, can be acquired only from a careful study of the mathematics relating to perfectly cylindrical shells with sharp corners where body and bottom join, for they are the basis for the entire art.

There are three dimensions occurring in cylindrical shell work, that lay claim to the diemaker's consideration: the diameter of the blank, the diameter of the shell and the hight of the shell.

Taking it for granted that no change takes place in the area and thickness of the metal while the blank is transformed into a shell, or while a shell of certain diameter and hight is redrawn to a shell of smaller diameter and greater hight, and that the metal is comparatively thin, then each of these three dimensions can be determined with the aid of the three following, well known formulas:

$$D = \sqrt{d^2 + 4\,dh} \qquad (1)$$

$$d = \sqrt{D^2 + 4\,h^2} - 2\,h \qquad (2)$$

$$h = \frac{D^2 - d^2}{4\,d} \qquad (3)$$

in which D denotes the blank diameter, d the shell diameter and h the hight of the shell, all in the same units.

To satisfy any of these formulas, it is necessary to know two of the three dimensions to find the third; a condition but very rarely met with in actual practice, as in the majority of cases, calculations have to be performed on the basis of one single known dimension and the condition that a given ratio must be maintained of one dimension to one of the others. The above formulas are, therefore, of a proportionately limited usefulness.

Ratio of Dimensions—Shell Hight to Blank Diameter

If, however, they are modified, by substituting for the symbols denoting actual dimensions, expressions denoting the dimension ratios to be reckoned with, these formulas at once become serviceable for all calculations in connection with die design and, at the same time, gain considerably in convenience.

Of the three dimensions, D, d and h, three ratios are possible.

$$\frac{h}{D}, \quad \frac{d}{D} \text{ and } \frac{h}{d},$$

which, for convenience of introduction into the above formulas, will be denoted hereafter as follows:

$$\frac{h}{D} = x, \quad \frac{d}{D} = y \text{ and } \frac{h}{d} = z.$$

Supposing, now, that in connection with the design of the dies for a certain vessel, only the diameter d of the vessel is known, and that surrounding conditions require that a certain given ratio exist between the hight h of the vessel and the blank diameter D; in other words, that the dimension d and the ratio $\frac{h}{D}$ is all the information at the disposal of the diemaker, who now must find the blank diameter D. To suit this situation, the symbol h in formula (1) must be exchanged for the expression $D\,x$, which expression states that D, if multiplied by x, will give h. Formula (1) thus altered, will appear as follows:

$$D = \sqrt{d^2 + 4\,dDx};$$

which, for practice, must be changed, so that it will assume the form:

$$D = d \times (\sqrt{1 + 4\,x^2} + 2\,x) \qquad (4$$

Ratio of Shell Diameter to Blank Diameter

Supposing, further, that the diemaker knows only the hight h of the vessel and the ratio $\frac{d}{D} = y$; then, in order to render formula (1) applicable for finding D from these data, the symbol d in the formula must be substituted by the expression $D\,y$, which will produce this form:

$$D = \sqrt{D^2y^2 + 4\,Dyh}.$$

By transposing this, the following is obtained:

$$D = h \times \frac{4\,y}{1 - y^2} \qquad (5)$$

Neither of the ratios x and y, so far introduced into formula (1), includes the dimension that is given; namely, d and h, respectively. The new formulas, (4) and (5), therefore, serve the distinct purpose of establishing from one dimension that is positively known, the values of the two others, which are but relatively known.

Ratio of Shell Hight to Shell Diameter

Coming now to the ratio $\frac{h}{d} = z$ and introducing it into the formula (1), there is, at first sight, a seeming want of purpose in doing this; because D, being the dimension to be found, either h or d and the ratio z must be given, which, however, is equivalent to both h and d being known and will satisfy the requirements of formula (1) as it stands. However, this want of purpose is, indeed, but a seeming one. For, in the first place, a scrutiny of formulas (4) and (5) will disclose remarkable simplicity and convenience for practical use, due to the introduction of the ratios x and y, respectively, and similar simplicity and convenience may reasonably be expected to result from the introduction of the ratio z. Secondly, the investigations and considerations in connection with drawing die design almost invariably refer to proportions and inter-relations of the dimensions; wherefore, a formula expressing and dealing with such inter-relations right from the start, must, of necessity, be welcome to the diemaker and facilitate the solutions of his problems by enabling him to start from the right point of view. Finally, formulas expressing the dimensions by their ratios, when represented by curves, yield especially instructive graphical demonstrations of the characteristics of the shell dimensions and the rules governing them; in addition to which, such curves are very serviceable for a quick and correct determination of the numerical values of D, d and h, from and under all conditions, and are for such purpose, far superior to any tables of shell dimensions, however complete such tables may be.

Further Results

Proceeding, therefore, with the introduction of the ratio $\frac{h}{d} = z$ into the formula (1), the symbol d must be substituted by the expression $\frac{h}{z}$, and the symbol h by the expression $d\,z$; when the formula will appear thus:

$$D = \sqrt{\frac{h^2}{z^2} + 4\,d^2z}.$$

As both, h and d, are practically known quantities, two forms are possible to which this expression may be changed, in one of which d is the given dimen-

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†Formerly chief engineer, the E. W. Bliss Company.

sion, and h in the other. These forms are:

$$D = d \times \sqrt{1 + 4z} \quad (6)$$

$$D = h \times \frac{\sqrt{1 + 4z}}{2} \quad (7)$$

Advantages of Using Ratio Formulas

The sequential introduction into formula (1) of the ratios x, y and z thus completed; whereby, for the determination of D, four new formulas were produced, and turning now to formulas (2) and (3), it is self-evident that the introduction of the three ratios into each of them will lead to similar results and can be effected in precisely the same manner as in the case of formula (1). In each instance four new formulas will result, those derived from formula (2) serving to determine d, and those from formula (3) serving to determine h. These additional eight new formulas are as follows:

From formula (2), to determine d:

$$d = h \times \frac{4y^2}{1 - y^2} \quad (8)$$

$$d = D \times \frac{1}{\sqrt{1 + 4z}} \quad (9)$$

$$d = D \times \frac{1}{\sqrt{1 + 4x^2 + 2x}} \quad (10)$$

$$d = h \times \frac{\sqrt{1 + 4x^2} - 2x}{x} \quad (11)$$

and from formula (3), to determine h:

$$h = d \times \frac{x}{\sqrt{1 + 4x^2} - 2x} \quad (12)$$

$$h = D \times \frac{z}{\sqrt{1 + 4z}} \quad (13)$$

$$h = D \times \frac{1 - y^2}{4y} \quad (14)$$

$$h = d \times \frac{1 - y^2}{4y^2} \quad (15)$$

It will be noted that all these new formulas are especially well fitted for actual use. The left side, denoting the dimension to be found, is always the product of two factors that appear on the right side, which are separated by a multiplication sign. The factor to the left of this multiplication sign is in all cases the given dimension, which, to solve the equations, is to be multiplied by the factors to the right of the multiplication sign, which latter factors contain the expressions of the ratios x, y and z.

Recapitulation of Formula Groups

A vivid impression of the importance of the new formulas will be had if they are condensed into six, by dividing both sides of the equations by the first factors on the right side and then regrouping them, when they will appear as follows:

$$\frac{D}{d} = \sqrt{1 + 4x^2} + 2x = \sqrt{1 + 4z} = \frac{1}{y} \quad (16)$$

$$\frac{D}{h} = \frac{4y}{1 - y^2} = \frac{\sqrt{1 + 4z}}{z} = \frac{1}{x} \quad (17)$$

$$\frac{d}{h} = \frac{4y^2}{1 - y^2} = \frac{\sqrt{1 + 4x^2} - 2x}{x} = \frac{1}{z} \quad (18)$$

$$\frac{d}{D} = \frac{1}{\sqrt{1 + 4x^2} + 2x} = \frac{1}{\sqrt{1 + 4z}} = y \quad (19)$$

$$\frac{h}{d} = \frac{x}{\sqrt{1 + 4x^2} - 2x} = \frac{1 - y^2}{4y^2} = z \quad (20)$$

$$\frac{h}{D} = \frac{z}{\sqrt{1 + 4z}} = \frac{1 - y^2}{4y} = x \quad (21)$$

Continuing the process of condensation, the formula

$$x = yz \quad (22.)$$

is finally arrived at, which is the fundamental expression of the correlation of the three dimensions D, d and h.

Diagrams to Express the Formulas

As stated in connection with the arguments that led to the introduction of the ratio z into formula (1), the curves demonstrating the new formulas are of special usefulness in all calculations to determine actual dimension values.

For the convenience of the reader, the curves of the twelve new formulas (4) to (15) are reproduced in pairs on the appended diagrams on a scale sufficiently large for practical application.

The six curves of Figs. 1, 2 and 3 conform to the six formulas that have been developed for those cases in which two dimensions have to be determined from one known dimension and the ratio the missing dimensions have to each other. The other six curves appearing in Figs. 4, 5 and 6 conform to the remaining six formulas, by the aid of which the third dimension is determined from two known dimensions, and which have been developed to a simpler, more practical form, by substituting for one of the known dimensions the ratio it has to its mate. These latter curves are also true representations of the original formulas (1), (2) and (3).

As each ratio naturally involves two dimensions, the curves are reproduced in each diagram in pairs, representing the dimensions thus involved in their relation to the third dimension; so that each diagram contains the values of all three dimensions, corresponding to the various values of the ratios of the respective formulas.

Examples from Practice

A clear understanding of the usefulness of the formulas, and especially of the curves, for quickly and correctly performing all calculations pertaining to shell dimensions can best be had from examples taken from actual practice.

Supposing, therefore, a number of steel shells has to be manufactured, the diameter of which is to be 10 inches and the hight 7½ inches. Instinctively, the diemaker will compare the shell diameter with the hight, because by thus comparing the dimensions and knowing the material to be worked, he will be able better to judge the several operations required to make the shells. He thus notes that the hight of the shell equals three-quarters of its diameter. Next, the question of the blank diameter asserts itself and may be solved by figuring from the dimensions of the finished shells with the aid of formula (1). This formula is somewhat cumbersome; but, if use is made of the already established ratio z, of the shell hight to the shell diameter, the operation can be performed with one of the new formulas in a much simpler manner, and is further facilitated by reference to the curve of the respective formula.

To find the blank diameter D from either the shell hight $h = 7\frac{1}{2}$ inches or the shell diameter $d = 10$ inches, and the ratio $z = 0.75$, formulas (6) or (7) are to be used; formula (6) to find D from d and z, and formula (7) to find D from h and z. Both formulas will give the same result and their curves appear in Fig. 6.

Assuming, in accordance with formula (6), $d = 10$ inches to be the given dimension, and referring to Fig. 6, the ratio $z = 0.75$ is located on the *scale of ratios*. Tracing over to the right, until the *curve of multipliers of d to find D* is reached, and from there down to the *scale of multipliers*, the latter will be met at a point corresponding to the value 2. This is the number, the product of which and the shell diameter d; viz., 10 inches $\times$ 2 = 20 inches, is the required blank diameter D.

As stated, the same result will be obtained from formula (7) and its curve, when the also known shell hight, $h = 7\frac{1}{2}$ inches, is to be taken as the given dimension. In this case, after locating $z = 0.75$ on the *scale of ratios* in Fig. 6, trace to the *curve of multipliers of h to find D*, and thence down to the *scale of multipliers*, which will be met at the point 2.67. Then, 7½ inches $\times$ 2.67 = 20 inches, as above.

First-operation Shell

Because of a fact which, for the time being, must be left to experience to stand for, and which will be the subject matter of future communications; namely, that the hight to which a steel shell may be drawn from the flat blank in one operation is limited to half the diameter of the shell (ratio $z = \frac{h}{d}$ must not exceed ½, or 0.5, for first-operation shells), more than one operation will be required to produce the supposed shells, in which $z = 0.75$.

This leads to the determination of the proportions of the first-operation shells. Knowing the blank diameter $D = 20$ inches, and the ratio z being 0.5, diameter d is defined by formula (9) and hight h by formula (13), the curves of both of which formulas appear in Fig. 3. Proceeding on the basis of formula (9), to find d, the ratio $z = 0.5$ is located

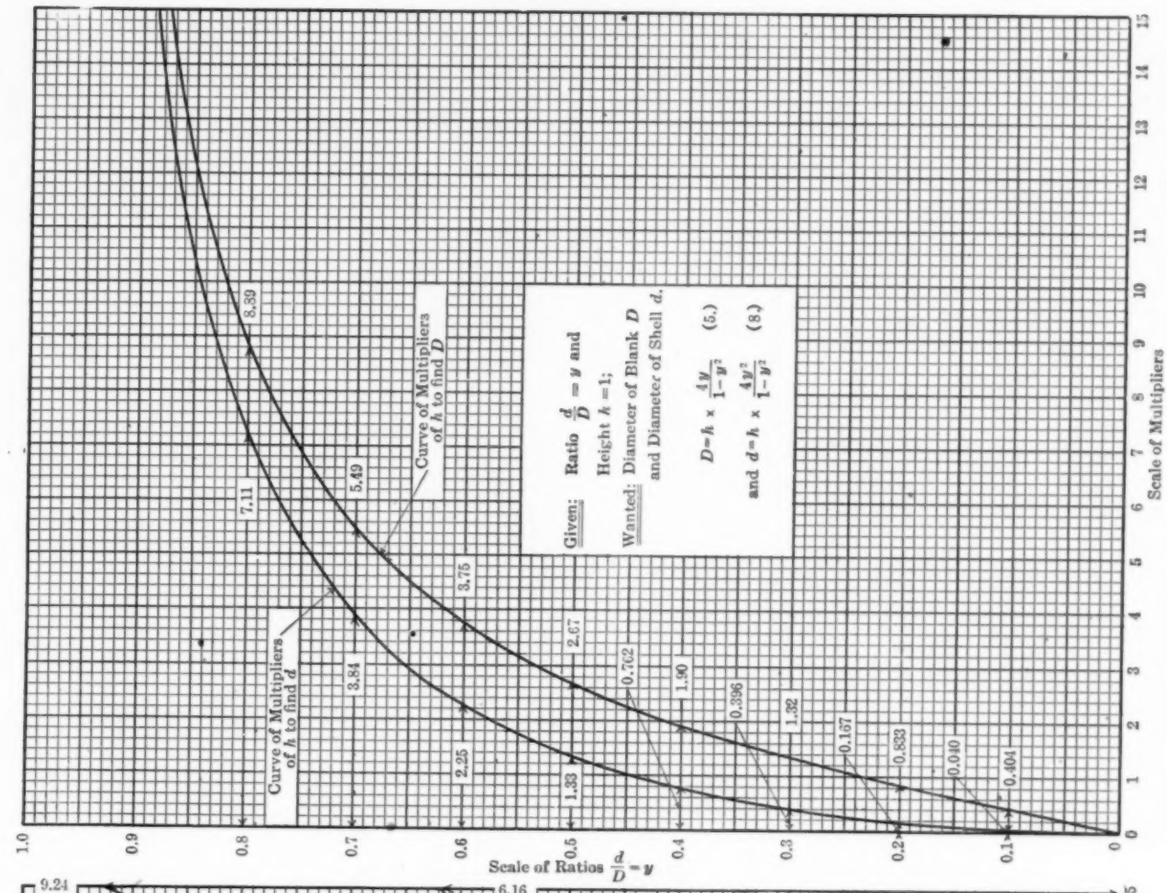

Given: Ratio $\frac{d}{D} = y$ and Height $h = 1$;
Wanted: Diameter of Blank D and Diameter of Shell d.
$D = h \times \frac{4y}{1-y^2}$ (5.)
and $d = h \times \frac{4y^2}{1-y^2}$ (8.)
Curve of Multipliers of h to find d
Curve of Multipliers of h to find D
Scale of Ratios $\frac{d}{D} = y$
Scale of Multipliers

FIG. 2. CURVES FOR FINDING BLANK DIAMETER D AND SHELL DIAMETER d, WHEN $\frac{d}{D}$ IS GIVEN

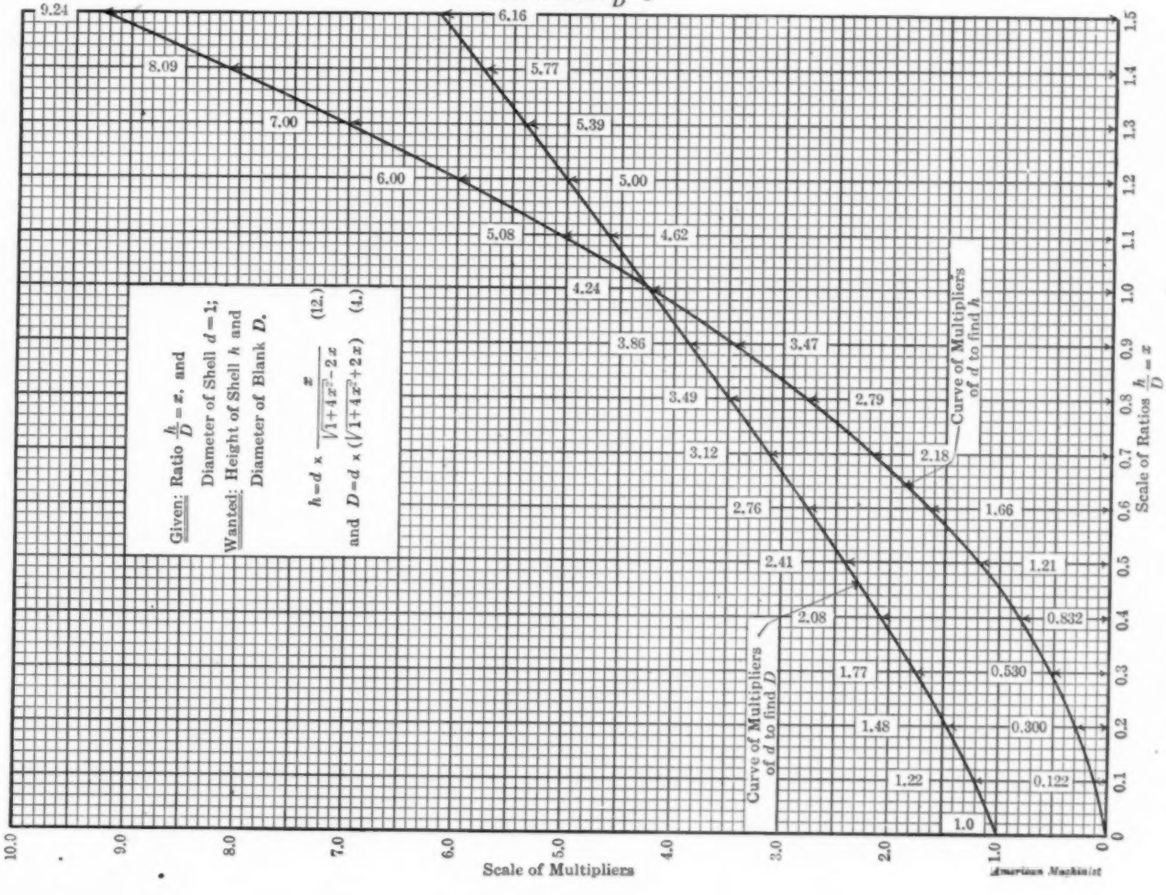

Given: Ratio $\frac{h}{D} = x$, and Diameter of Shell $d = 1$;
Wanted: Height of Shell h and Diameter of Blank D.
$h = d \times \frac{x}{\sqrt{1+4x^2}-2x}$ (12.)
and $D = d \times (\sqrt{1+4x^2}+2x)$ (4.)
Curve of Multipliers of d to find h
Curve of Multipliers of d to find D
Scale of Ratios $\frac{h}{D} = x$
Scale of Multipliers
American Machinist

FIG. 1. CURVES FOR FINDING SHELL HIGHT h AND BLANK DIAMETER D, WHEN $\frac{h}{D}$ IS GIVEN

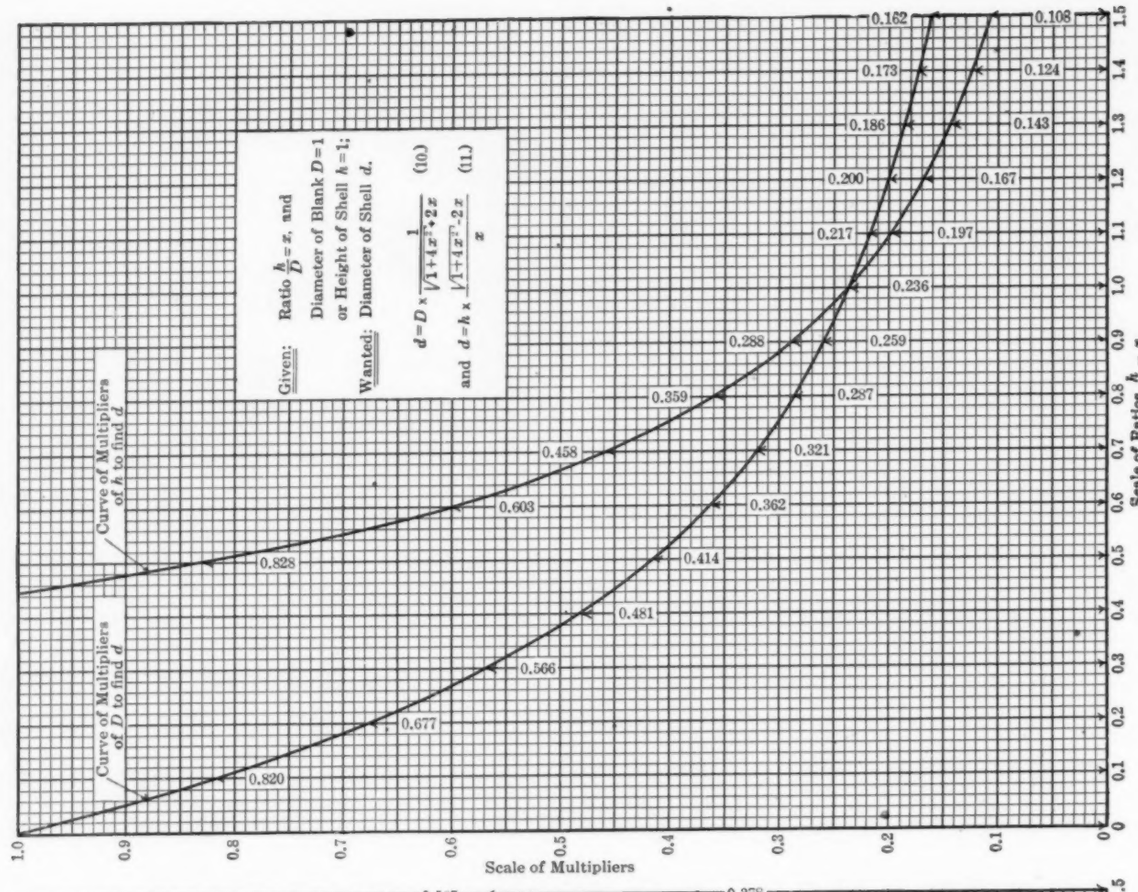

Given: Ratio $\frac{h}{D}=z$, and Diameter of Blank $D=1$ or Height of Shell $h=1$;
Wanted: Diameter of Shell d.
$d=D\times\frac{1}{\sqrt{1+4z^2}+2z}$ (10.)
and $d=h\times\frac{\sqrt{1+4z^2}-2z}{z}$ (11.)
Curve of Multipliers of h to find d
Curve of Multipliers of D to find d
Scale of Multipliers
Scale of Ratios $\frac{h}{D}=z$
0.828 0.603 0.458 0.359 0.288 0.236 0.200 0.186 0.173 0.162
0.820 0.677 0.566 0.481 0.414 0.362 0.321 0.287 0.259 0.236 0.217 0.197 0.167 0.143 0.124 0.108

FIG. 4. CURVES FOR FINDING SHELL DIAMETER d FROM EITHER BLANK DIAMETER D OR SHELL HIGHT h, WHEN $\frac{h}{D}$ IS GIVEN

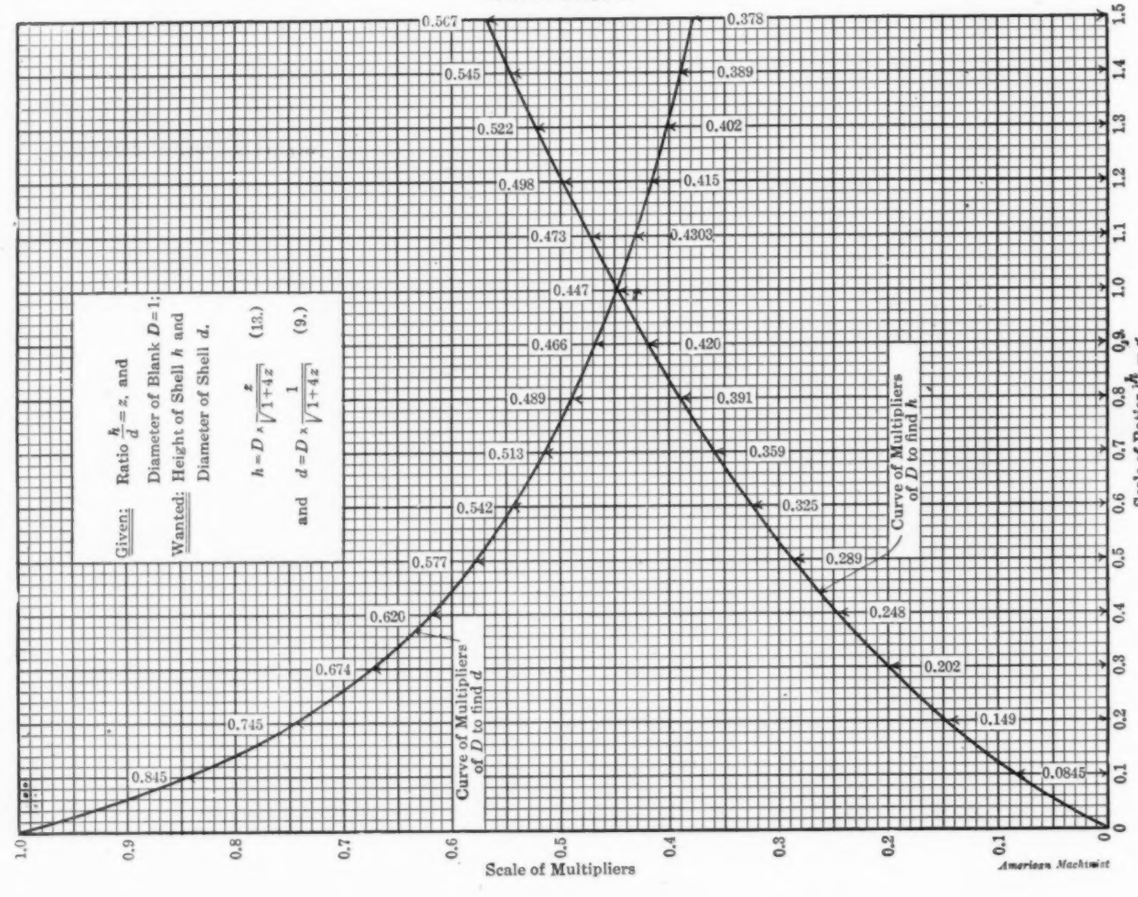

Given: Ratio $\frac{h}{d}=z$, and Diameter of Blank $D=1$;
Wanted: Height of Shell h and Diameter of Shell d.
$h=D\times\frac{z}{\sqrt{1+4z}}$ (13.)
and $d=D\times\frac{1}{\sqrt{1+4z}}$ (9.)
Curve of Multipliers of D to find d
Curve of Multipliers of D to find h
Scale of Multipliers
Scale of Ratios $\frac{h}{d}=z'$
0.845 0.745 0.674 0.620 0.577 0.542 0.513 0.489 0.466 0.447 0.473 0.498 0.522 0.545 0.567
0.0845 0.149 0.202 0.248 0.289 0.325 0.359 0.391 0.420 0.4303 0.415 0.402 0.389 0.378
American Machinist

FIG. 3. CURVES TO FIND SHELL HIGHT h AND SHELL DIAMETER d, WHEN $\frac{h}{d}$ IS GIVEN

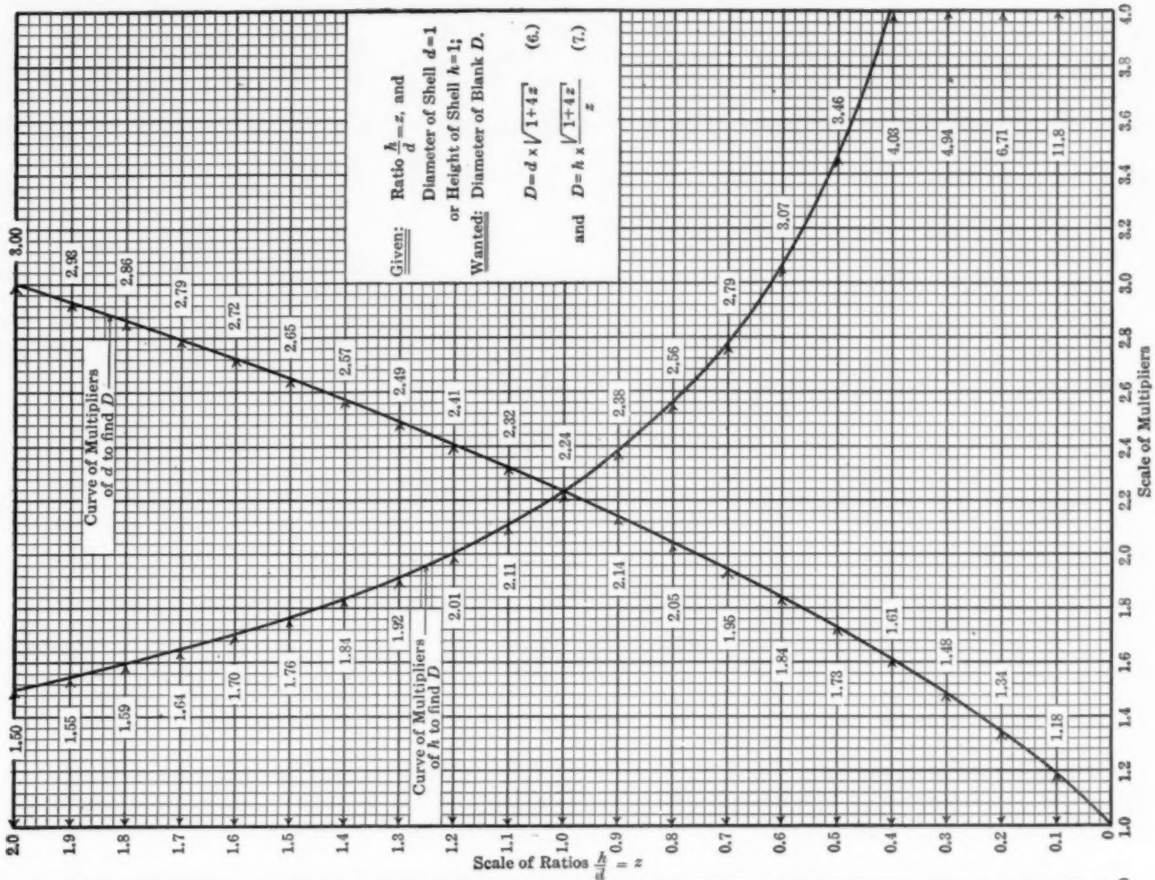

Given: Ratio $\frac{h}{d}=z$, and
Diameter of Shell $d=1$
or Height of Shell $h=1$;
Wanted: Diameter of Blank D.
$D=d\times\sqrt{1+4z^2}$ (6.)
and $D=h\times\frac{\sqrt{1+4z^2}}{z}$ (7.)
Curve of Multipliers of d to find D
Curve of Multipliers of h to find D
Scale of Multipliers
Scale of Ratios $\frac{h}{d}=z$

FIG. 6. CURVES FOR FINDING BLANK DIAMETER D FROM EITHER SHELL DIAMETER d OR SHELL HIGHT h, WHEN $\frac{h}{d}$ IS GIVEN

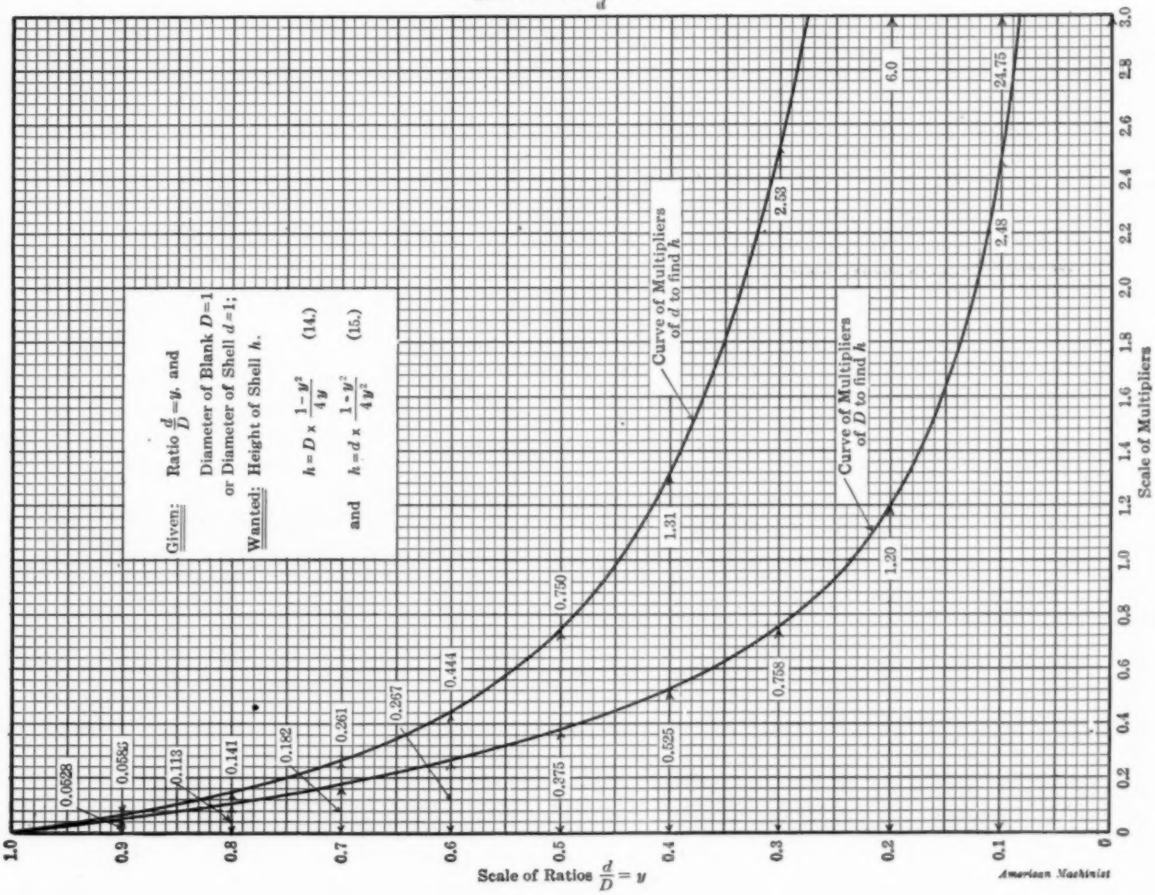

Given: Ratio $\frac{d}{D}=y$, and
Diameter of Blank $D=1$
or Diameter of Shell $d=1$;
Wanted: Height of Shell h.
$h=D\times\frac{1-y^2}{4y}$ (14.)
and $h=d\times\frac{1-y^2}{4y^2}$ (15.)
Curve of Multipliers of d to find h
Curve of Multipliers of D to find h
Scale of Multipliers
Scale of Ratios $\frac{d}{D}=y$
American Machinist

FIG. 5. CURVES FOR FINDING SHELL HIGHT h FROM EITHER BLANK DIAMETER D OR SHELL DIAMETER d, WHEN $\frac{d}{D}$ IS GIVEN

on the *scale of ratios*. Tracing upward to the *curve of multipliers of D to find d*, the number 0.577 is found on the *scale of multipliers*. Then, blank diameter 20 inches $\times$ 0.577 = 11.54 inches, is the diameter d of the required shell. On the basis of formula (13), to find h, in Fig. 3 trace up to *curve of multipliers for D to find h*, and on the *scale of multipliers* find 0.289. Then, blank diameter 20 inches $\times$ 0.289 = 5.78 inches, is the required shell hight h.

This also could have been found by the fact that h had to be 0.5 d, but the ratio z is not always so simple.

Press Hight Capacity Limited

The blank diameter D and the limiting proportions of the first-operation shells being thus established, let it be further supposed that there are several dies on hand, one of which might come in to draw the first operation shells; but that the only press available for the purpose is limited in hight capacity to 5 inches. For the selection of the proper die, it is necessary to find out what kind of a shell would result if the blank diameter D is 20 inches and the shell hight h only 5 inches. Of course, formula (2) could be used for figuring this tentative shell, but it will be easier to use a formula based on the ratio $\frac{h}{D} = x$. The ratio x is seen to be 0.25, and D and h being known, either formula (10) or (11), their curves appearing in Fig. 4, will produce the required information.

Proceeding with formula (10), and referring to Fig. 4, the ratio $x = 0.25$ is located. Tracing to the *curve of multipliers for D to find d*, the corresponding point on the *scale of multipliers* is 0.618. Then blank diameter 20 inches $\times$ 0.618 = 12.36 inches, is the diameter of the shell looked for, and which is 5 inches high.

Proceeding with formula (11), the curve in Fig. 4 not being sufficiently extended, the ratio $x = 0.25$ would be inserted and by solving 12.36 inches, again is found to be the diameter of the tentative shell 5 inches in hight. An existing die 12⅜ inches diameter is then used for this first operation.

Relation of Shell Hight to Blank Diameter Limited

Continuing the supposition; the stock to fill the above order has come in in sizes that did not cut to advantage, leaving considerable good sized scrap. The diemaker, in course of time, receives instructions to use up the scrap to fill a new order calling for a number of endless sheet-steel bands, 5 inches in diameter and 2 inches wide, to be cut from drawn shells. Annealing must be avoided as expensive.

From experience with the same steel and similarly proportioned dies, the diemaker happens to know that when the hight h of the shell produced in the successive operations approaches about ¾ of the blank diameter D, annealing becomes necessary for further operations. Hence, he must settle on an ultimate shell hight h, the ratio x of which, to the blank diameter D, must not exceed ¾, or 0.75.

To find the suitable blank diameter D from the known shell diameter $d = 5$ inches, and the ratio $x = 0.75$, formula (4) may be used, or the shell hight h may be found from the same data, by using formula (12). The curves of both of these formlas are reproduced in Fig. 1.

Turning to Fig. 1, and proceeding according to formula (4), to find the blank diameter D, the ratio $x = 0.75$ is located. Tracing to the *curve of multipliers for d to find D* and thence to the *scale of multipliers*, the number 3.30 is found. Then, shell diameter 5 inches $\times$ 3.30 = 16.5 inches, is the required blank diameter D.

Proceeding according to formula (12), to find h, and tracing from $x = 0.75$ to the *curve of multipliers of d to find h*, the number 2.48 is found *on the scale of multipliers*. Then, shell diameter 5 inches $\times$ 2.48 = 12.4 inches, is the required shell hight.

Redrawing—Determining Press Stroke

Supposing further that, of the first-operation shells of 12⅜ inches diameter previously made, a considerable number has been left over and are to be redrawn into shells 8 inches diameter. To find a press of suitable depth capacity for the final operation, it is necessary to know the resulting shell hight h. Of course, formula (3) could be used to find it, as both blank diameter $D = 20$ inches, and the new shell diameter $d = 8$ inches, are known; but it would be simpler to use the ratio y, of shell diameter d to blank diameter D, as expressed by the formulas (14) and (15). The curves of these formulas appear in Fig. 5.

Referring to Fig. 5 and proceeding in accordance with formula (14), and noting that the ratio $y = 0.4$, this is located on the *scale of ratios*. Tracing to the *curve of multipliers for D to find h*, the number 0.525 is found *on the scale of multipliers*. Then, blank diameter, 20 inches $\times$ 0.525 = 10.5 inches, is the required hight h.

Proceeding in accordance with formula (15), we have $d = 8$ inches; after again locating $x = 0.4$, tracing to the *curve of multipliers for d to find h*, the number 1.31 is found *on the scale of multipliers*. Then, shell diameter, 8 inches $\times$ 1.31 = 10.48 inches, again the required shell hight h.

Shell Bottom Proportion Limited

Changing the supposition to an order for nickel vessels to be used in connection with certain storage batteries, the specifications state that the vessels must have a hight of 10 inches, but that not more than ¼ of the total inside area shall be used for the bottom of the vessel.

These requirements will be met by shells in which the shell diameter has to the blank diameter the ratio of 0.5, because circular areas are to each other as the squares of their diameters, and so the blank diameter D must be twice the shell diameter d. The hight $h = 10$ inches being known, and also the ratio $y = 0.5$, the blank diameter D may be found from these data by formula (5), and the shell diameter d from formula (8). The curves of both these formulas appear in Fig. 2.

Proceeding, in accordance with formula (5) to find D, and referring to Fig. 2, the ratio $y = 0.5$ is located and, tracing to the *curve of multipliers for h to find D*, the number 2.67 is found on the *scale of multipliers*. Then, hight, 10 inches $\times$ 2.67 = 26⅔ inches, is the blank diameter D.

Proceeding in accordance with formula (8), to find d, and tracing from ratio, $y = 0.5$, to the *curve of multipliers for h to find d*, the number 1.33 is found on the *scale of multipliers*. Then, hight, 10 inches $\times$ 1.33 = 13⅓ inches, is the diameter d of the shell.

The illustration of all the formulas, (4) to (15), and their curves, by examples being now completed, it may be stated in conclusion that, although these examples occur daily in actual practice, and in an endless variety, they yet illustrate only a very small part of the uses to which the new formulas and curves may be put. Indeed, their importance for considerations of the effect the physical properties of the metals have upon the sheet-metal drawing process, and for all study of the laws governing that process, cannot well be overrated, and such considerations and study will be the subject of future articles.

The Automobile is responsible for the following interesting figures: Automobiles made in the United States in the year 1910, 187,000; machine tools required in car building, 135,000; men engaged in manufacturing cars, 187,000, thus, it takes one man one year to turn out a car. Dependent directly upon these employees, 935,000 persons; passenger miles per year, 12,045,000,000; giving per capita mileage for United States citizens of over 120 per year; distance represented, 481,800 trips around the world; it would take 100 pounds of $10,000 bills to buy the year's product.

Letters from Practical Men

Concerning the details of making things in machine shops, from the first sketch to the shipping room. A letter good enough to print will be paid for. The value is in the idea—not the length of the letter

A Cheap Automatic Down Feed for a Shaper

It is often both economical and convenient to use the vertical slide of the shaper head in planing sides of work already set up in the vise. But as most shapers are not ordinarily equipped with an automatic vertical feed, such operations are tedious, and in some cases, impracticable. The following simple and inexpensive down feed may be made from materials whose total cost is about $0.75 and a few hours' time.

In Fig. 1, *A* is a common ratchet wrench, bent in order that it may pass beneath the handle, having a square of the same size as the diameter of the end of the feed screw. One corner of the square may be filed as shown in detail, to fit over the spline. The wrench is placed as shown in Fig. 2, and as the wrenches are usually very thin, nearly a full nut may still be obtained when the wrench and handle are in place. *B* is a stop to prevent the spring *C* pulling the wrench too far around when the ram is on the back stroke. *D* is a stationary upright to which the chain *E* is attached. A light brass chain is used, as it allows the feed to be easily changed by shortening or lengthening at the hook on the upright *D*, by as many links as may be desired.

The one disadvantage of this arrangement has been that it has been impossible to raise the slide after it had been fed down without removing the chain and stop or the ratchet. This, however, may be overcome by the device shown in Fig. 3. *F* is a small pin, either screwed or soldered into the pawl so that by pushing the pin in the direction shown, the pawl will be disengaged and thus allow the screw to turn backward and raise the slide.

The feed is set by allowing the tool to overrun the work an inch or so. The chain should be tight when the tool is just leaving the work, and in moving this additional distance the wrench will feed the slide down. Then on the back stroke the spring *C* will pull the wrench back against the stop to its original position. The amount of feed per tooth will depend upon the number of teeth and the pitch of the screw. In the instance I am describing the feed is 0.004 inch per tooth, which is fine enough for most work. No claim is made for originality in the principle of this arrangement, but its cheapness and simplicity should recommend its use on the shaper in many small shops.

This arrangement can be put on and adjusted in the time that it takes to adjust one of the regular automatic feeds as furnished by the makers of the machine.

Elizabeth, N. J. C. R. BARTON.

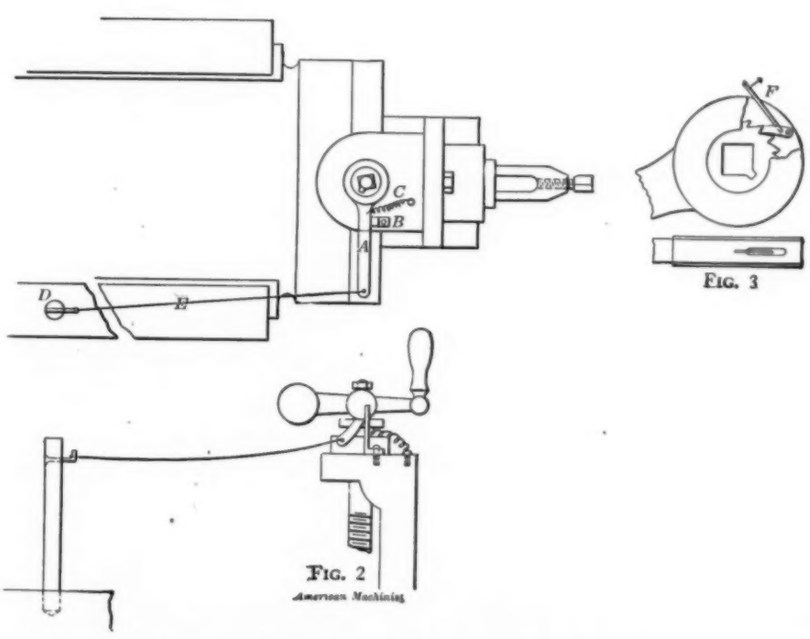


FIG. 2

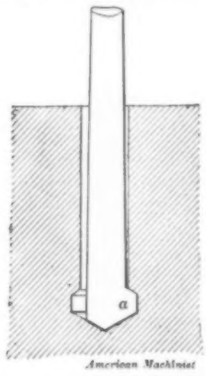
FIG. 3

A CHEAP AUTOMATIC DOWN FEED FOR A SHAPER

An Undercutting Drill

It is often necesary in machine construction to thread holes for pins or studs, which are only to have a certain depth, so that the piece cannot be drilled way through.

To cut the thread to the bottom of the drilled hole requires special pains because of the danger of breaking the tap, experience teaching that taps thus broken off are very hard to remove.



AN UNDERCUTTING DRILL

This difficulty may be avoided by undercutting the drilled holes with the boring tool here shown.

The tool, which naturally must have a width the size of the drilled hole, is formed like an ordinary flat drill, but the point is made one sided by an amount somewhat more than the depth of the thread that is to be cut, so that there remains a cutting edge. This edge is sharpened, and the point of the drill so blunted that it will not deepen the hole.

If this drill be used for finishing a hole bored to a certain depth, the outstanding edge cuts a ring-shaped groove in the work until the blunt point of the drill reaches the middle of the hole.

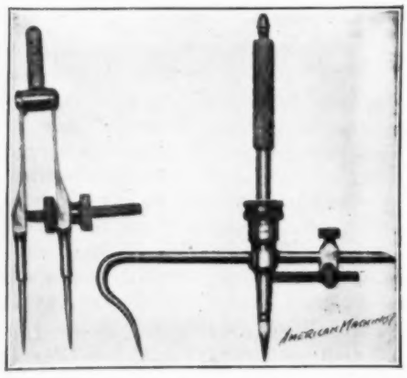
The thread can now, as easily as if the hole were bored completely through the work, be tapped with taper, plug and bottoming taps.

Magdeburg. MAX USBEK.

An Improved Divider and Trammel

The accompanying halftone shows two homemade machinists' tools which have been found very handy and useful.

The first is a pair of dividers of improved form. In scribing circles or arcs with the ordinary dividers, there is more or less tendency for the scribing leg to spring away from the true outline toward the center, which causes trouble on close and accurate work. The pair of dividers illustrated herewith is provided with a check nut behind the scribing leg, which totally prevents the springing trouble. Most of the dividers on the market do not possess this feature.



AN IMPROVED DIVIDER AND TRAMMEL

The other tool is a pair of homemade trammels. The leg used for a center is made somewhat longer than in the usual form; but otherwise is nearly like that of the L. S. Starrett tool, being provided with a nut for clamping to the beam, and micrometer screw for close adjustment. The scribing leg differs from the usual form, however, in being bent up from the end of the beam in the curved form shown. This makes a more rigid leg for the scribing point than is the case where the latter is a separate, movable piece, sliding on the beam.

The fine curved point interferes less with the sight also than does the leg of the movable form, which is somewhat more bulky.

J. H. HARRIS.

Philadelphia, Penn.

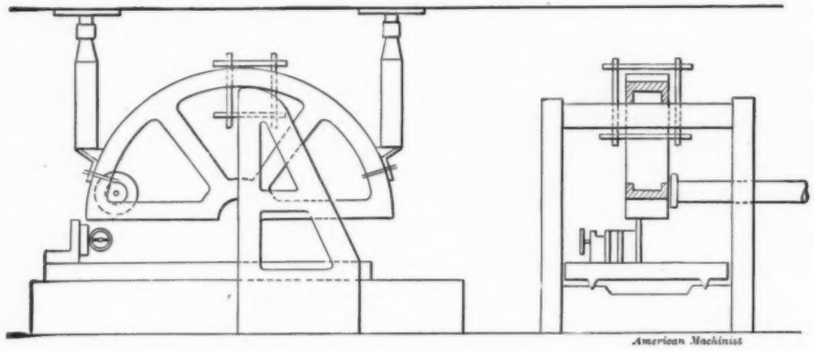
A Big Job on a Small Planer

The cut shows a planer job I saw done in the Bangkok Dock Company machine shop in Bangkok, Siam, about five years ago.

A large cast-steel split gear for a rice mill shipped from Europe, when put together was found to have been insufficiently planed on the joint to the extent of ¼ inch one side and 3/16 inch the other. The planer available was much too small for the half wheel to be bolted to the table, so the tool slide was taken down. The cross stay between the housings was temporarily removed and then replaced, passing through the wheel which was bolted to it, and shored down from the roof and shored and bolted sideways to the wall of shop. The tool box was carried on an angle bracket at the extreme end of the table, and half the joint planed, then the bracket was moved along the table and the other half planed, the travel of the table being insufficient to take in the full length of the joint at one stroke.

L. H. MORGAN BROWNE.

Mexico City, Mex.



PLANING A BIG JOB ON A SMALL PLANER

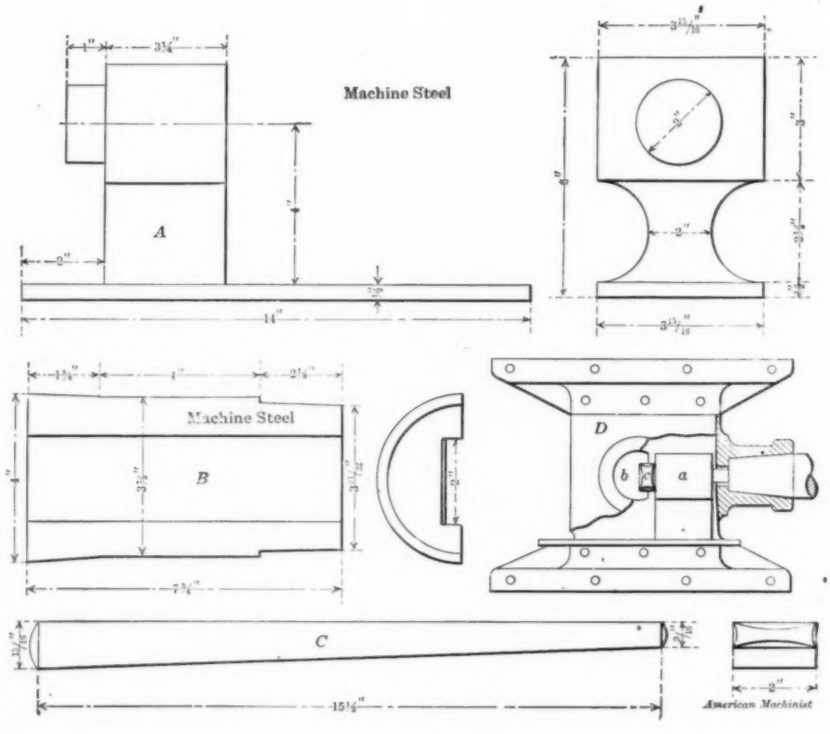
A Piston Rod Remover

The method used in the Chicago & Northwestern Railroad shop, at Clinton, Iowa, for removing piston rods from alligator crossheads is illustrated in the accompanying line cut: *A* is a block made of such a hight from the bottom to the center of the round boss, that when it is placed on the crosshead slipper, the boss will enter the piston-rod fit and rest against the end of the piston rod; *B* is a turned piece, fitting the wrist-pin hole of the crosshead, and which has a flat on one side and a keyway for wedge *C*.

The position of the various parts in use is shown at *D*, the small lettering corresponding to the large letters of the separate parts.

CHARLES MARKEL,
Shop Foreman.

Clinton, Iowa.



A PISTON-ROD REMOVER

Grinding on a Shaper

The E. M. Erb Manufacturing Company, 87 Greene street, Jersey City, N. J., has two neat grinding fixtures for use on their shaper, both of which are shown in Fig. 1.

The fixtures need little explanation except that the main bearings are set on a cast-iron block, which is placed in the clapper box and held in by a large screw, a hole being drilled and tapped in the back of the clapper box for the purpose.

The ram and its bearings are covered with canvas to keep out the emery dust thrown off while grinding.

The grinder is driven from an extra countershaft, shown in Fig. 2, the idler set into a piece of heavy 4x4 oak, keeping the belt taut during the stroke of the ram.

Punches, dies and all sorts of grinding jobs common to the small shop, are quickly and satisfactorily done with one or the other of these fixtures.

New York. E. V.

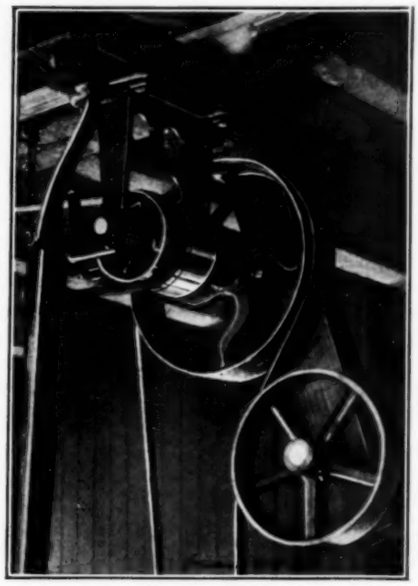


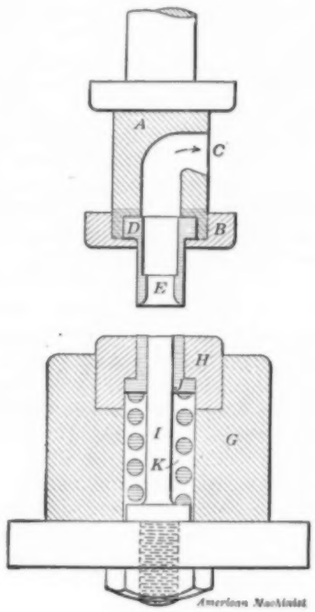
FIG. 2. COUNTERSHAFT AND IDLER USED WITH SHAPER GRINDING FIXTURES

Self-ejecting Shell Blanking and Drawing Tools

The accompanying sketch shows a set of tools for the blanking and drawing of small shells, illustrating an easy method to eject the finished product without hindering the operator. The main bodies of these tools, punch *A* and bolster *G*, can be made so that other cutters and dies can be substituted, this being convenient when shells are required with just a small variation in dimensions. Punches and bolsters should be numbered so that pillars, cutters and dies may correspond.

Body of punch *A* is of mild steel, threaded at face end to receive mild steel, carbonized and hardened cap *B*. Care is required that the boring of punch at *F* has a smooth finished surface, so that the shells shall drop clear through and out at the side exit.

Cutter *D* is of cast steel, hardened in oil and drawn to dark straw color. Inside draft *F* and outside dimensions of cutter *D* to be left for grinding. This cutter stands 1/64 inch over face of *A* so that, when cap *B* is screwed home by means of wrench or peg spanner, the cutter is firmly held. Bolster *G* is of cast iron, bored to receive die *H* and pillar *I*, the latter screwed into the base and fastened by means of lock nut beneath. Pillar *I* must run accurately with the boring in bolster for die. This is an easy mistake to make, believing that when the pillar is screwed home it must be true, but it may be otherwise.



SELF-EJECTING DIES

Die *H* is of cast steel, hardened in water and drawn to light straw. It must be bored out, an allowance being made for grinding to size of blank. The slide *J* is also cast steel, hardened in oil and drawn to deep straw. This slide fits pillar *I*, acts as a pressure plate and ejects the shell after completion. A stripper was fixed on the bolster, which I have not shown.

In operating this device, oil must be used and the metal wiped clean of dust. This is a much neglected necessity, one which tends to lengthen the life of tools of this description. The first shell is cut and drawn to the full extent of draft *E* so that, in the operations of shells to follow, the pressure of air between the finished shell and the shell in operation causes each finished shell to shoot clear of *F* and out at side exit *C*, where we had an arrangement to receive them.

These tools can be worked on a fast self-feeding press. The spring is to support the pressure of slide *J*.

WALTER LAWRENCE.

Coventry, England.

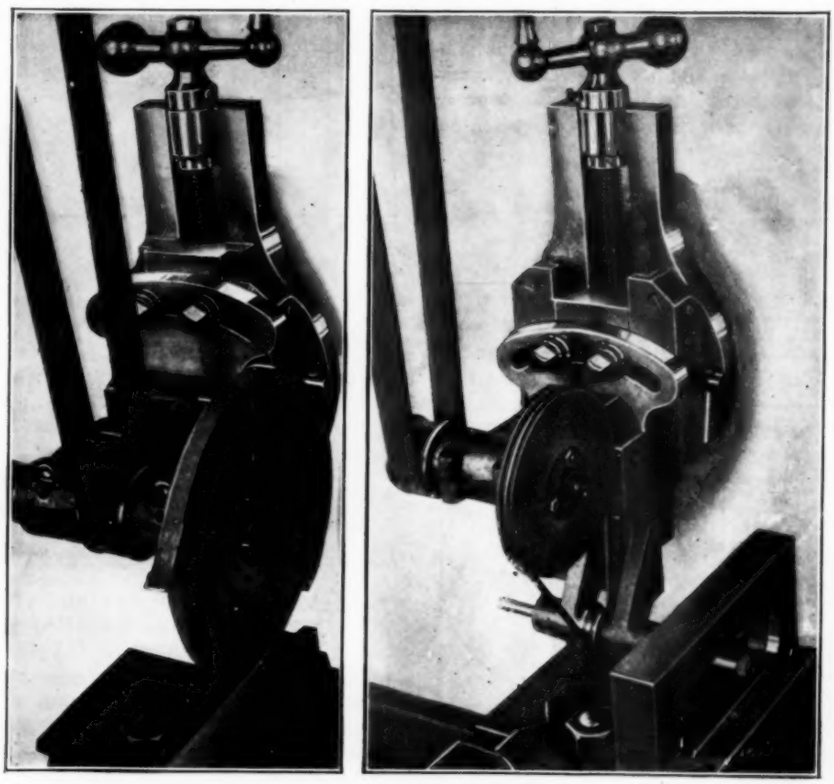


FIG. 1. GRINDING ON A SHAPER

Making a Case Ring

In making case rings, which are practically handles for cans as Fig. 1*A*, round brass stock was used, bent to shape, the end threaded and screwed and soldered into the case.

After being in use for some little time many rings worked loose, or broke away from the case, no doubt in many instances from ill usage. However, an improvement was necessary and we hit upon the design Fig. 1*B;* which after being used for some time has proved far more satisfactory than Fig. 1*A*. The following method of manufacture has been found satisfactory.

The rings are first blanked and pierced from soft brass sheet in the punch press, annealed and formed into shape between dies under a heavy punch press. The forming dies were made first and trial blanks were used until the correct size of blank required was formed.

It was found necessary to gage the stock used in blanking so that a uniform thickness was assured. Fig. 2 shows the blanking tool, which consists of a tool-steel die fitted with mild-steel stripper plate and a punch holder fitted with piercing punch and blanking punch with pilot pin.

Fig. 4 shows the forming tools consisting of two dies of hardened and tempered steel. The slots shown milled in the dies at *A* are for removing the rings with the aid of a steel spike. The two pins shown are to keep both top and bottom dies concentric.

The forming operation made the rings the proper hardness and the very minute fin left around the rings was easily removed in the buffing. The hole in the rings being reamed, they are then dipped and cleaned.

They are then sent to the milling department to be milled as follows:

A 4-inch Brown & Sharpe flanged vise is fitted with a pair of special jaws as shown in Fig. 3, a gang cutter is made up, and the right arc is milled leaving the two projections; as per Fig. 1*B*, the right length and width for riveting to the case. Using a special fixture upon a riveting machine the ring is riveted to the case. The whole is then dipped, plated and polished.

Woolwich, London. J. W. DAY.

A Locating Punch for the Milling Machine

The accompanying sketches show a handy tool for the milling machine, which has proved to be both useful and time saving for laying out and prick punching, perforating, blanking, or other similar dies on the milling machine when the holes for same can be more quickly and conveniently drilled in the sensitive drill than on the milling machine.

Fig. 1 shows a side view of the tool which hardly needs any explanation. The piece *A* is made of tool steel and is 2⅛ inches long, 1½ inches wide by ⅞ inch thick and the hole fits the arbor of the milling machine. The prick punch *B* is made a good sliding fit and the pin *C* prevents the punch from being drawn too far up by the spring *D*.

Fig. 2 shows an end view of the tool set up in the milling machine ready for use. The die to be laid out and prick punched is held in a holder that fits the taper hole in the index head of the milling machine, and it will be readily understood that by moving the table or by turning the index head, the required position for any number of holes can be quickly and accurately found and prick punched at the same time by lightly tapping the punch with a small hammer.

After all the holes have been marked, the die is removed, and the holes are drilled and reamed taper in the sensitive drill press.

I do not wish to go on record as saying that I consider this method superior to the button or disk method for accurately locating holes in their proper positions for the reason that this tool is intended only for use in cases where the holes are so numerous and so close together that to use the button or disk method would be out of the question.

CHAS. DOESCHER.

Waterbury, Conn.

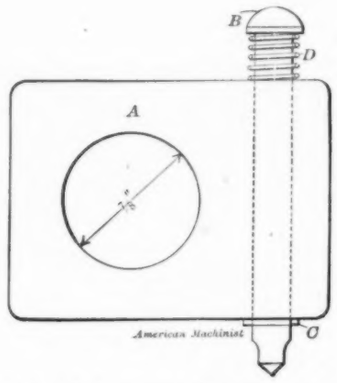


FIG. 1. A LOCATING PUNCH FOR THE MILLING MACHINE

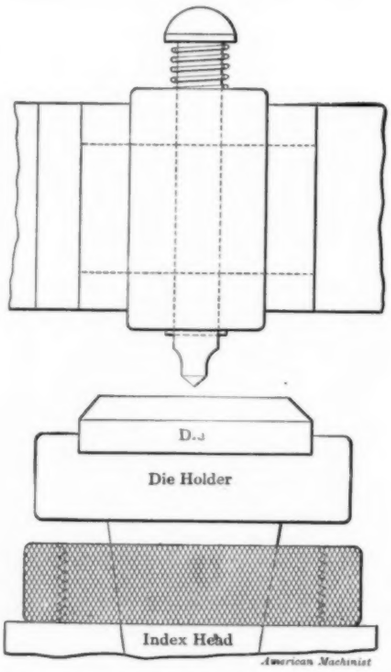


FIG. 2. LOCATING PUNCH AND DIE TO BE MARKED, IN POSITION ON MILLING MACHINE

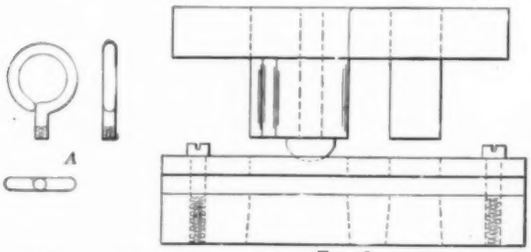


FIG. 1

FIG. 3

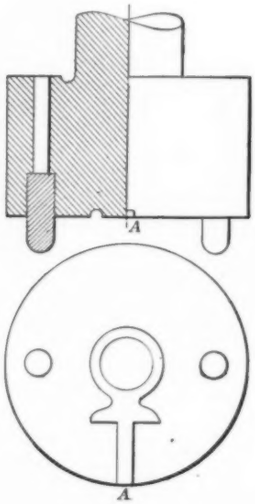


FIG. 4

MAKING A CASE RING

Discussion of Previous Question

Letters from our readers showing how many men of many minds look upon various subjects opened up in previous numbers

Winding Flat Copper Strip Coils

Having seen an article on page 113, Volume 33, Part 2, on the winding of copper strip on edge, I think it might interest some of your readers to know of our method of doing this on round coils. We make coils of various sections and diameters; from 0.039 inch thick to 0.59 inch, and widths varying from 0.787 to 1.77 inch; diameters of coil inside, from 1.57 to 7.87 inches.

After experimenting in various directions, we finally hit upon this method, which has the merit of being inexpensive in the making and produces a first class coil with very few tools. Fig. 1 shows mandrel or shaft between centers of lathe, with cast-iron angle block firmly fixed to saddle. Mandrel is turned to size of bore of coil wanted, and cast-iron angle block is bored a running fit for mandrel. Mandrel is driven by chuck jaws. A steel disk shown at *A*, Fig. 1, with set screw, is shrunk on mandrel for the purpose of carrying copper around when starting up.

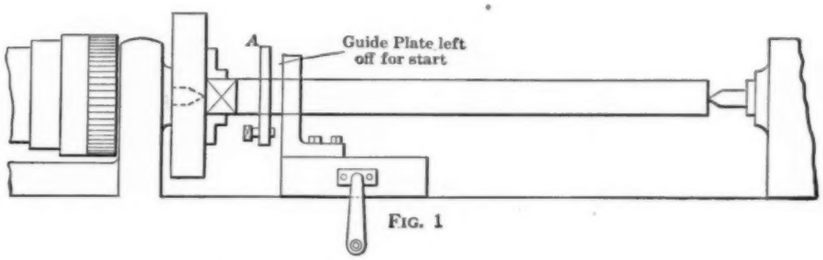


FIG. 1

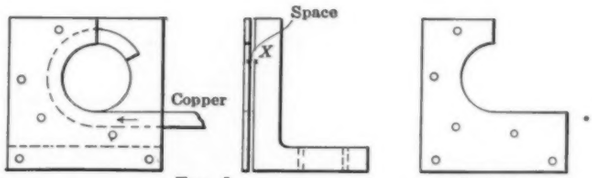


FIG. 2

FIG. 3

American Machinist

WINDING COPPER STRIP COILS

At Fig. 2 is shown the angle block in two views, with mild steel plate ¼ inch thick attached. This plate is fixed to angle plate by round-head screws, and butts on stop pins fixed into angle block. These stop pins keep plate far enough from face of angle to provide just sufficient space to let copper slide through, as shown at *x*, Fig. 2. I have shown the path taken by copper, in Fig. 2, between plate and angle block. In Fig. 3 is shown the plate; it will be noticed it is cut away at top in line with center. This is, of course, the place where copper leaves the block after winding round mandrel.

To start up, angle block on saddle is brought up to face of disk on mandrel, leaving enough space, to allow copper to slip between. Guide plate is left off for this first operation. Set screw is at bottom position, as shown. Copper is placed on set screw, a hole being drilled in copper to suit plain end of screw, the screw protruding only far enough through to take thickness of copper. The lathe is given a half turn, either by power or hand, bringing set screw to top position. This gives a half coil on mandrel; it is understood that angle block is meantine pressing copper against disk on mandrel.

The saddle is now drawn back, bringing end of copper off set screw. Guide plate, Fig. 3, is fixed firmly on with screws against stop pins in angle block. Saddle is brought back till guide plate touches disk on mandrel; copper again is held on set pin by hole. Lathe is started up and saddle eased back gently from disk as copper winds round mandrel. After a couple of turns, saddle may be left to itself, as copper in winding pushes saddle away from disk by pressure between guide plate and disk.

Any length of coil may be made, depending upon length of mandrel. After long coil is finished it is cut up into sections and ends straightened out by being heated and hammered. These ends are made straight for connectors, if desired. Coils can, of course, be wound singly and straight ends left to desired length. This, however, means starting new for every coil and is not so quick as winding continuous strip.

The reel of copper may be fixed to saddle of lathe, or placed on a trolley on shop floor. It also is advisable to allow copper to pass through a simple tension block of any kind fixed on saddle, just before entrance to angle block. This straightens out copper and allows it to enter between plate and block more sweetly.

There are only one or two points to be noted here. Face of angle block must be machined, also face of guide plate, fairly smooth. Guide plate, especially on very thin copper, must be a nice fit against stop pins, just to allow tight sliding fit for copper. A little oil on strip also helps it to work through block more smoothly.

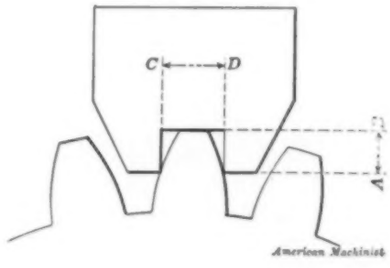
We at first geared up lathe as for screw cutting, to as near pitch of coil as possible, but found after a few trials this was totally unnecessary as, if saddle is kept fairly easy on shears, it will move along by pressure of winding.

R. C. STEELMAN.

Alloa, Scotland.

A Gear Tooth Gage

The gear-tooth gage, shown on page 740, Volume 33, Part 2, is not so accurate as it seems.



A GEAR-TOOTH GAGE

The cut herewith shows a gage that is more accurate. It not only shows the proper width but the proper depth as well.

A B is the depth of tooth on the pitch line, *D C* is the width of tooth on the pitch line. If the tooth is out either way, light will show between the gage and the top of the tooth, assuming the gage to be accurate.

This gage can be made standard or to fit sample.

Tarrytown, N. Y. H. L. W.

Diameter of Shell Blanks

J. L. Moore, on page 75, points to a deficiency in C. P. MacArthur's formula, published some time ago,

$$m = \frac{h\,t}{T},$$

which, though its reality must be admitted, will hardly ever assert itself by appreciable differences between calculated and actual shell hights, when already comparatively thin walls are still more reduced.

As a matter of fact, Mr. MacArthur's formula is nothing more nor less than the algebraic expression of the manner in which the effects of reducing the walls of copper and brass shells, etc., are commonly estimated, and is absolutely in keeping with the general custom in all light sheet-metal drawing of treating the thickness of the metal as a negligible quantity.

That this is done with justification, and that, after all, the formula in question is not so very far out of the way, can best be shown by the corrected figures of the shell in Mr. MacArthur's example: If the hight of the shell of 2 inches diameter, after reducing the thickness of the walls of the body from 0.04 inch to 0.02 inch must be exactly 6 inches, then the "mean hight" of the shell, from which the blank is figured, must not exceed 2.9706 inches, which is less than 1/32 inch less than the 3 inches stated in the example. If, on the other hand, 3 inches is near enough for the "mean hight," the resulting shell will be 6.0594 inches high, which, again, is so little in excess of the 6 inches quoted, that it will surely not make up for the irregularities of the upper edge, that are bound to occur and to take care of which a liberal allowance is generally made when fixing the "mean hight" of the shell, and the blank diameter.

Mr. Moore has proved his case by making comparison between the proverbial "flee and elephant" and in doing so, he happens to use, as an example, a shell of such dimensions as very frequently occur in heavy tank and tube drawing, and exemplified by the flasks for storing oxygen in oxyacetylene welding, air accumulators, carbonic-acid bottles, shrapnel and other projectiles, cream separator bowls, etc. That in connection with such work the "flea and elephant" be not confounded, a correct formula for obtaining the "mean hight" of a shell is here given:

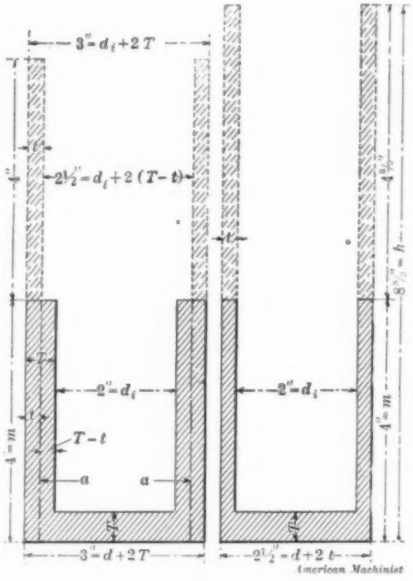
$$m = \frac{h}{2} \times \frac{d_i + (T - t)}{d_i + (1\tfrac{1}{2}\,T - t)},$$

in which

m = Mean hight;
h = Hight of finished shell;
t = Thickness of finished shell;
T = Thickness of metal before drawing;
d_i = *Inside* diameter of both shells.

This formula was derived from the following considerations:

Fig. 1 shows a "mean shell" of the identical dimensions as quoted by Mr. Moore. Reducing the walls from ½ inch to ¼ inch, is equivalent to pushing the outer ring of metal, ¼ inch thick, upward along the dot and dash lines *a*, and into



DIAGRAMS OF SHELL DRAWING

the position indicated by the dotted lines. This ring of metal is 4 inches high, the same as the "mean shell," but its diameter is too large and has to be reduced by ½ inch to match the shell and become a continuation of it. The effect of this reduction manifests itself by the additional hight of the ring of metal, that concerned Mr. Moore. Of course, the actual reducing process is somewhat different, but the result is the same.

In heavy shell drawing it is just as important to determine the hight of the finished shell that will result from a given "mean shell"; wherefore, the following formula is quoted:

$$h = 2\,m \times \frac{d_i + (1\tfrac{1}{2}\,T - t)}{d_i + (T - t)}.$$

In conclusion, the blank in the case of heavy shell work should be figured from the bulk of the metal contained in the shell; that is, its weight. The figures in Mr. MacArthur's table, which Mr. Moore has "checked and found correct," are not applicable without preparatory calculations, and carry with them the same "error" of ignoring the thickness of the metal as the formula in question, which error, it must, however, be added, is of absolutely no significance, if the application of formula and table is confined to the work for which they are intended and for which they are of undebatable value.

OTTO S. BEYER.

East Rutherford, N. J.

A Little Courtesy

On page 178 is an editorial that would bear framing and hanging in every contractor's office. It is entitled, "A Little Courtesy," and offers the novel suggestion that letters of thanks be written to unsuccessful bidders. I use the word "novel" because I feel sure that this custom is never, or so rarely that no one ever hears of it, resorted to among contractors.

For some time I was estimator for a heating and ventilating company in New York City and it was my custom, after sending the figure on any job, to enter it in a card index. If we were awarded the job the card was marked "Accepted" and put in another index. When we found that we were unsuccessful the card was marked "Not Accepted" and filed in a third index. But here is where the difficulty came—to find out whether we were to get the job or if it was to go to someone else. Often it required much telephoning and many letters before we got the desired information and it usually came from an indirect source. Often a job would be half finished before we found out that it had even been awarded.

As I look back, I can see what a large amount of time and energy would have been saved if each contractor had written a couple of lines, as suggested in the editorial, stating that we were unsuccessful and thanking us for our trouble. Thus a little courtesy would have done much to temper our disappointment.

Washington, D. C. W. L. DURAND.

Making Tubular Frame Micrometers

In connection with this subject, article on which appears at page 207, I note the statement that the Patent Office considered it impossible to make the bends in such thin metal and then close it in. Permit me to state that O. F. Evert and myself invented this very rig which is shown as a development of the Davis Manufacturing Company on which evidently a patent has been secured. A circular gotten out by the undersigned in 1904 shows these micrometer frames.

A. J. MACHEK.

A. J. Machek & Co., Milwaukee, Wis.

Detail Drawing

Alban Rice's little homily to draftsmen on page 918, Volume 33, Part 2, will doubtless be read with much interest, and may, we hope, profit. However, it seems to me that there are some important points which he has overlooked. He puts all the fault down to the draftsman, whereas there are many outside influences to be taken into consideration.

Mr. Rice's chief trouble lies in the erratic manner in which detail drawings are sometimes dimensioned. That this trouble does exist cannot be denied. In my opinion, it may be put down in some measure to the fact that in a number of drawing offices work is always rushed through on principle, whether it is particularly urgent or not. Work turned out under such conditions may be quite correct, as far as figures go, but it hardly allows the draftsman the time, even if he has the inclination, to "spend more care and study in dimensioning drawings and to use more judgment and logic on the subject . . . ." as mentioned by Mr. Rice.

Then, again, much depends on whether there is any check or restriction on the style of drawing turned out. Does it not imply rather too much faith in human nature to expect that detail drawings should always come up to a certain standard, if there is no care taken to insure that they come up to that standard. The method or want of method in dimensioning details which freely passes in some offices would never be tolerated in others.

If a workman is furnished with limit gages and micrometers and told to work to certain specified limits, no one will expect him to be particularly careful about keeping within those limits, unless there is a definite check on the work turned out. In his case it is the inspector or examiner.

Some firms insist on detail drawings being made and figured according to certain methods. Naturally they get their drawings made according to their standard. This is just as natural as that a firm which allows each draftsman to follow his own sweet will should get drawings turned out according to individual tastes and ideas.

Would not most of the troubles mentioned by Mr. Rice vanish if he would have for his checker an experienced man, thoroughly familiar with his particular pet style of arranging and dimensioning detals, and give this man instructions not to pass any drawings which were not in accordance with the method agreed upon? It would not be long before drawings came up to the style required, if the draftsman knew that otherwise they would be rejected and he would have the trouble of altering them. Such an arrangement might cause a few cuss words when introduced, but there is no reason why it should not work smoothly.

It follows in drafting as in most other work, that you get what you pay for. If you have cheap (?) men for checkers and detailers, it is hardly reasonable to expect that their work should be first-class in every respect.

Value of Shop Experience

Mr. Rice mentioned shop experience. It is rather a curious fact, but it will frequently be found that extended shop experience is no guarantee that a man will make a good draftsman. Many good men are to be found in this line who have had practically no actual shop experience, while it is not uncommon to find a competent workman quite at sea when asked to express his ideas on paper.

Mr. Rice mentions a young draftsman, who, after three years in the business, asked his advice regarding a book on gearing, and said that this was the only thing he did not know much about; he knew all the rest. This young man must have been quite modest, as he did confess there was something he did not know much about.

This kind of thing obtains in every trade. I knew a boy, who, after 10 months at the bench, wished to enter the drafting room, at the same time casually remarking that he had learned all there was to learn in fitting.

Mr. Rice says that when detail drawings are under way, the shop foremen should be consulted on the different parts to be made in their respective departments. Their advice is very valuable, and the draftsman should not try to get along without it. If every point the least doubtful is carefully studied in this manner, etc.

According to this a detail draftsman has power to call a committee meeting of foreman and anyone else interested. In the consultations which take place over a set of details, between the superintendent and heads of departments, as to the best methods of machining, or alterations which will conduce to easier handling or machining, the detailer has very little voice. Most of this kind of thing is settled over his head. All he has to do is to carry out the instructions given him.

Also, I have a pretty strong opinion that if a draftsman went to see the shop foreman every time he had the least doubt about anything which was to be made in the said foreman's department, the poor foreman would soon have to learn a new language, as his mother tongue would be quite inadequate to allow him to express his thoughts with sufficient force and feeling. Or, if he happened to be of a pugilistic nature, the draftsman while recovering would have time to reflect on the difference between giving and taking advice.

Examples Hardly Typical

An examination of the examples given by Mr. Rice will show that some appear to be unusual or are cases for special consideration, while others may be said to be dummies erected for the express purpose of being knocked down again.

Take Fig. 22, for instance, where he complains that nurling increased the diameter of the head of the piece, and says that the thoughtful draftsman would have specified diameter of head after nurling. It does not require much foresight to see that nurling will increase a diameter, the same as thread rolling. As a matter of fact, the dimension lines are usually taken over the outside diameter of the head. This is, in effect, giving the diameter of the head after nurling. But how often does a nurled head require to be exact to size? It is rather absurd to take an example of this kind, which is quite an isolated case in the experience of many, and hold it up as a typical error.

Then, take Fig. 23, a cast arm which has a 3/16-inch cold-rolled steel shaft going through it. The shaft has to be a drive fit in the arm, and the shaft varies in diameter. Mr. Rice lays down that the hole should be dimensioned *somewhat* smaller, and the parts fitted in assembling. Is he not going out of his way to provide us with a very far-fetched example? It would appear to the uninitiated to be a very curious way of turning out repetition work. By what economical process is the assembler going to make a drive fit between a hole of a definite size and a shaft which varies in diameter. As the ends of the shaft are turned down, it would appear to the casual observer that the common-sense method would be to machine the 3/16-inch portion of the shaft.

Tool Steel Economy

In an article by L. E. Dickinson, of Holyoke, Mass., page 74, Volume 34, Part 1, under the above heading, I read about making taps and dies out of Mushet and Sanderson steels. Mr. Dickinson overestimates the intelligence of the general run of readers, when he considers that he has made this matter clear. Mushet steel is one of the most difficult of all steels to work. This forging, milling, planing and shaping done so easily as to be "surprising" is something a little new to me. I think nine out of every ten who have had very extensive experience with this steel, will be a little dubious about the ease with which these operations are performed. In the first place, to make a tap out of Mushet steel you have to turn and either cut or mill the thread. Mr. Dickinson has not told us how this was done, whether he works it dry or uses cutting compound. I have milled, planed and turned Mushet steel but have never been able to make a tap out of it, either in a lathe or in a miller. I have tried lard oil and several kinds

of cutting compound, and found that as soon as I put any of them on I ceased to be able to cut it at all.

As for making a die out of Mushet steel, well, I give that up. Mr. Dickinson will have to show me.

He anneals in a pipe filled with powdered lime. Is the lime slacked, or unslacked? He heats to whatever heat the pipe will stand. What does he mean?

Mr. Dickinson's experiment no doubt was a success, but his description of it and its results is so vague and indefinite that it merely serves to suggest a series of experiments along this line, instead of telling in detail the things he actually learned, so as to be of practical use to everyday practical people.

In drawing out the scrap steel, he heats slowly and thoroughly. To what temperature, or color? Why does he not give more in detail the proper temperature to which to bring a certain size of steel before beginning to draw it out, and point out in some way to what extent it may be allowed to cool during the drawing process, and still avoid all danger of checking and breaking by hammering it when it is too cool?

These are things which people who are accustomed to buy these steels in sizes requiring no drawing and little forging, naturally wish to know. The last shop I worked in, all the small high-speed steel was forged out; and I am not exaggerating when I say, fully one-half of the cutting tools so made were spoiled, being full of little checks and cracks.

He has told us enough only to set us guessing and experimenting on our own account, keeping back the information which would have enabled us to profit by the fact of his having made what he calls a successful experiment.

Springfield, Mass. MUSHET.

That Cracked Compressor Cylinder Head

I was interested in the account given at page 123, of the finding and repairing of a crack in the cylinder head of an air compressor. There are some things about it which I do not understand. For instance, in Fig. 2, what connection is there between the gage and air pipe and the water chamber of the cylinder head, and how was the testing pressure really applied?

As to the accumulation of water in the receiver, did not the writer know that water always is deposited there by normal compressed air, and that a "relief" cock *C* is always provided to relieve the receiver of the water which is sure to accumulate? As the crack in the cylinder head would not leak water until a pressure of 30 pounds was applied, and as the water pressure in the jacket was only two or three pounds, as is to be inferred from the sketch, how could it have leaked water into the air cylinder?

It is quite possible that the crack would allow some air to escape into the water when the 80-pound pressure came on, but if in any such quantity as suggested by the sketch, how much air would have been delivered to the receiver?

It is interesting to know of the closing of the crack by oxyacetylene welding, and it shows how handy and familiar the process is becoming.

New York City. FRANK RICHARDS.

Industrial Education

The comments of Entropy on page 15, have induced me to contribute my "mite" on this important question. I realize that I cannot do justice to this subject in a brief article like this, for the question of industrial education is a very broad one, and requires for its solution serious thought and extensive study.

Having, however, been an employee in the machine trade for 20 years, in different positions, first that of apprentice and then up the line to that of superintendent; during this period associating with and employing several hundred boys and men—some of the boys from manual-training schools and colleges; in addition to this, having had two years' experience as instructor in machine work in a college, and now for the past two years holding the position of head of the machine department of an industrial school, perhaps the deductions from my observations may be of interest to your readers.

THE NAME

The first thing to consider is a suitable name for these institutions. I agree with Entropy that a spade should be called a spade, that the word "Vocational" is dead, and an obituary will soon be printed on "Industrial Education." The name that appeals to me as best suited to this purpose is "Preparatory Trade Institute." I maintain that at present it is impossible for these schools to teach a trade, and I question whether they will ever be able to do so. I doubt if there is a manufacturer today who will give a boy who has served his full school apprenticeship journeyman's wages, unless he is an exceptionally bright boy or is running a special machine.

The next important essential is a suitable place in which to give this trade instruction. Right here I believe is where a great mistake is made in erecting a $15,000 building, with $50,000 equipment, and employing a $900 a year teacher. The building should be of ordinary mill construction, thus placing the boy in an environment as nearly as possible like that which he will encounter while he is working at his chosen trade. As to equipment, the only kind of machines on which to turn loose a green boy are those discarded by manufacturers who are installing in their place rigid high-speed machinery; I venture to guess—using the second-hand machine advertisement in the AMERICAN MACHINIST as a basis—that there are any number who would be glad of a market for these machines.

If these schools attempt to produce a marketable product on uptodate machines with inexperienced boys, they will drive their instructors insane trying to preserve these nice machines and keep spoiled work from piling up under the bench.

TEACHERS

This problem is a mill-stone around the neck of trade instruction, and yet it does not seem to me to be very difficult to solve, for I believe that the best teacher is a man who can conscientiously instill into the boy his own experience. Of course, this experience should consist of not less than 10 years' actual shop work, including some executive practice, and two years' training in teaching. An instructor should have patience and ability to appreciate boy-nature. I may be optimistic, but I believe this man can be developed in the following manner.

To develop a machine instructor ask the head of any firm to select a man who he thinks will "fill the bill;" then let this man take a course in some good college for training teachers. There are many men who would embrace this opportunity if they were assured of a better position than they now hold. The salary of these teachers must be large enough to act not only as an inducement but also as a means through which the teacher may be made competent, and this I feel in the long run will prove a wise investment.

The instructor in English and mathematics, as well as the shop instructor, should have commercial shop experience. Such a man can be developed by taking a man who already has good academic training in these subjects, and giving him the opportunity to obtain the necessary shop experience, which in his case need not cover more than two years. This creative process may not be necessary but a few years, for these schools will finally develop their own instructors.

SYSTEMS

There are several being tried out at present, but the scheme mentioned by Entropy as having been suggested by Carroll D. Wright, and which has been in practice in the New Bedford Industrial School for two years, appears to me as being the best. Boys can enroll in this school when they are 14 years of age. For two years, each boy is given instruction in all the departments. These are academic, science, machine and woodworking. This gives the boy an op-

portunity to discover what trade he would like to adopt, and the faculty time to study the boy in order to properly advise him in making his selection. In the machine department, during this period, the green boy when he is due in the shop, is told to make himself at home. At the same time, the assistant with two or three of the older boys are told to look out for him, and they see that he is kept busy cleaning the machines, helping, etc.

In this way he is taught to avoid danger points, to learn the names of the many machine parts—in fact, to familiarize himself with the machines in general. Along with this he is taking elementary shop mathematics and shop drawing. When he has advanced to the point where in the judgment of the instructor he is able to work on a machine or bench, he is given a piece of work on an order that has previously come to the head of the department through the office. H. is instructed in making a drawing and figuring the amount and cost of material used, and in starting the job. When the job is finished, he sums up the total cost from the time he rang in on the time clock until he rang out and makes a written report on this work from start to finish. This report and these calculations are used as the basis of his English and mathematical instruction.

This "job routine" is typical of the other departments and thus far has proven quite satisfactory. At no time is a boy allowed to do exercise work. All work from the office order to the finished product follows regular shop practice as closely as is possible with the equipment. The advanced students work on uptodate machines and through vacation periods obtain work—frequently through the help of the school—in local shops. They are expected to bring written reports on this work from their foreman, and these reports are considered by the instructors when a boy applies for promotion.

A boy is promoted whenever he is qualified, and an earnest boy of good ability can secure a diploma in somewhat less than four years.

The next problem is how to supply enough work for these schools. This can be accomplished by what I call the "cyclical" process. That is, dig out of the many "graveyards" gas engines, small steam engines, and various other machines, overhaul and repair them, make new patterns and break up the old castings to use as foundry iron for casting new parts. With occasional "digging," these schools in this manner could be supplied with work indefinitely.

I believe a "Preparatory Trade Institute" of this type, while it cannot teach a boy a finished trade, will present to the manufacturer a boy who, in everything except speed—for speed is attained only after years of practice—will be a hundred per cent. better than the boy trained under the old method of apprenticeship.

LEWIS H. HAIGHT.

Head of Machine Department, New Bedford Industrial School.

Automobile Engine Proportions

The writers have carefully noted Mr. Stevenson's criticism on Page 269, in reference to their articles on automobile engine proportions, and in reply and by way of explanation desire to make the following statements:

To work out the desired results, as suggested by Mr. Stevenson, by arithmetic or by finding arithmetical averages, would have been well nigh impossible and quite impractical from both standpoints of amount of work involved and accuracy; the latter being the vital consideration. The great numbers of values which had to be used and, above all, the different weights which had to be given to those taken from better designs as compared to those from poorer motor designs, would immediately place such a method out of the question. This was one of the features most carefully considered in the preparation of these formulas and the following method finally was adopted:

Let us consider, for example, the case of finding an equation giving "valve diameter" in terms of "cylinder diameter." All values of valve diameter are plotted as abscissas with corresponding values of cylinder diameter as ordinates. Then, taking careful note of all points, the best possible average curve is drawn through the points plotted and its equation determined. Equations also are found for curves giving maximum and minimum values and these are given in all cases where this was deemed important. Had it been possible, it would have given the writers pleasure to publish these curves, as they show at a glance the general scope and range of sizes used in the best and most common motor designs of the present day.

Now considering the first formula to which Mr. Stevenson refers; namely, that giving the relation between stroke and cylinder diameter, the writers desire to state that common practice for the best and most common designs of motors gives a range of cylinder diameters of from 3½ to about 5¼ inches. Our formulas are intended to apply only within this range and cannot be expected to hold accurate to values much below or above those just given. This does not at first glance appear to be a very large range; but upon careful inspection it will be found that by far the greatest majority of auto-motors do not overstep these limits in either direction.

For the benefit of those desiring a formula without an added or subtracted constant, the following one is given: $L = 1.1\ D$; where L equals stroke in inches, and D equals cylinder diameter in inches as in the other formula. It may be stated that the tendency has been toward the long-stroke motor and this formula may even now give results lower than the very latest practice would dictate.

In regard to the formulas on wrist-pin diameters, the same may be said to apply as has been stated above; namely, that the range of applicability naturally is limited to the best and most common designs of the present day.

By "actual standard bolt sizes" is meant the A. L. A. M. standard. The reason for this statement was merely to make it emphatic that results are given as diameters over the thread, and not diameters at root of threads.

The writers find that Mr. Stevenson's adverse criticism of their formula for crank-pin length in terms of cylinder diameter is quite justified, and greatly regret that such an error should have crept into their work. It may be stated that crank-pins as used vary from "square" (bearing diameter equal to crank-pin bearing length), in both directions; namely, that in some cases the diameter is greater than the length and in others the opposite is true. For this reason it may be well to give only the limits as found, and let the designer make the pin design as will best suit his conditions, being careful, however, that the pin is strong enough in shear, etc., and that the projected area is sufficient to take care of the excessive bearing pressure to which the pin is subjected naturally.

Crank pins for motors having cylinder diameters ranging from 3½ to 5½ inches have diameters varying from approximately 1½ to 2¼ inches, and crank-pin lengths varying from somewhat less than 2 to 3¾ inches. One pin may be square (say 2x2-inch), while for a different cylinder diameter a 2-inch pin may have a length of 3 inches or even more, in extreme cases; the vital points being pin strength and reduced bearing pressures, as has been noted above.

The remainder of Mr. Stevenson's discussion hinges on the formulas for finding crank pin diameter from cylinder diameter. It was found by the writers after the article had been published, that both of the formulas given are slightly in error, and the following equation consequently is submitted. $Dcp = 0.31\ D + 0.3$ inch. This equation consequently will apply, not only in the case of the crank-pin diameter; but also for the three bearing diameters, front, center and rear.

This formula will be found to give results between those previously given and, if used within the limits previously stated, should be found entirely satisfactory. Absurd negative results will not be found if the limits in which these equations are used are as have been specified.

We desire to thank Mr. Stevenson for his interest and discussion and trust that our explanation may prove satisfactory to all interested in this line of work.

Grand Rapids, Mich. A. G. KESSLER.

An Indicator for the Milling Machine

On page 692, Volume 33, Part 2, Mr. Melville expressed the hope that an indicator would be discovered which would meet the demand of button work on the milling machine.

The following shows my idea of an indicator for that purpose: This indicator is especially constructed for button work and can be used without removing the tool from the spindle for either outside or inside work within its range by using a suitable formed leg *E*. It can also be used on the lathe by clamping it to the tailstock spindle, therefore, the tool can be left undisturbed in the toolpost and much quicker work can be done.

In the milling machine, of course, the drill and boring tool must be combined. The indicator is clamped to the end of the spindle, therefore not depending on the hole, and is used while the machine stands still by swinging from one position to another and moving the table until the point stands in the same position, when the machine is revolved a full revolution. *A* is the spindle; *B* a ring to which the scale is fastened; *C*, the set screw; *D*, the scale; *E*, the adjusting leg; *F*, the rocker arm; *G*, a nurled nut; *H*, a washer; *I*, a bolt; *J*, a screw, the end of which fits the oblong hole in *F*; *K* is a screw clearing in *L*; *L* is the pointer, and *M* the spring.

To make the graduations on the scale to register thousandths as near as possible, clamp the indicator to the spindle and let *E* rest against something; set the index on the milling-machine screw on zero and the pointer in center position. Now turn the screw and index 0.001 inch and make a line on the scale for every 0.001 inch, and with this particular leg or another of exactly the same length, the registering will be 0.001 inch.

A greater range than is shown in the drawing may be obtained by making the scale adjustable on *B*.

Perth Amboy, N. J. F. W. STEUER.

The Bronze Box

On page 183, appears an article by Professor Sweet, "Is the Bronze Box a Good or a Bad Thing," followed by an interrogation point. We are all pleased as well as instructed with anything from the pen of the professor, and by the clear and often humorous way in which he presents his views upon the subject in hand.

In regard to the practice of using bronze for boxes in machine tools, it seems to me that there is a generally prevailing opinion that it is the best adapted of any material for all-around use. But, even, if the bronze is simply a selling point, is there any good reason why it should not be used? Most machines are made to be sold and the makers spend large sums of money in advertising. Most machine builders are in the business for the profit there is in it. Now why not use bronze, even if it does cost a little more than cast iron, give the purchaser what he wants, and at the same time increase the maker's sales and profit? We sometimes read in the report of an official representative of the United States, that if the maker of articles or machines would study the needs or desires of the people of other countries, instead of trying to sell them what he thinks is best for them, our foreign trade would be very apt to show a gratifying increase.

But aside from the selling point of view, the professor has given us some facts that are well worth consideration.

Cast iron certainly does show some remarkably good wearing qualities in many places, and from what I have seen personally I would be almost ready to believe any statement about these good wearing qualities. But, while cast iron may wear well, many of us know to our sorrow that when cast-iron bearings begin cutting the rapidity and ease with which they cut themselves out is something akin to a crosscut saw going through a pine board. If we view the question from the point of how much damage may be done in a short space of time if the bearing does get dry, we may better understand why bronze is so generally used.

On some classes of machinery, for instance, grinding machines where a high rate of speed must be maintained with the minimum of play, it is difficult to keep the bearings properly lubricated at all times in such manner that they will not seize or cut. If cast iron is used the box may be rendered useless in a very short time.

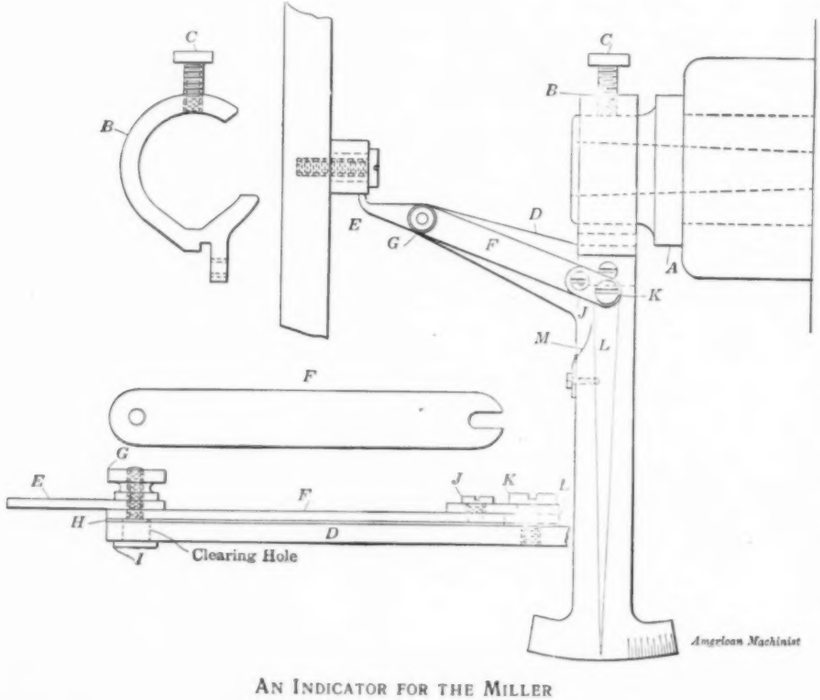
I can recall instances in using a universal grinder where the wheel stopped from having the bronze boxes too closely adjusted. Upon being loosened slightly everything would go right along and no harm done. Most of us can imagine what would be the result if the boxes had been of cast iron.

One point in favor of bronze for boxes or bearings is, if it does get to cutting the spindle or shaft does not load up in a ridge that cuts deep grooves into the boxes as does cast iron. In the case of cast iron when the shaft sticks in its bearings it generally forms hard spots or ridges which in some cases can neither be turned nor filed off. If the box is a solid one and has to be slid or driven off, it is often badly damaged, if indeed a new one is not needed altogether.

It strikes me that before we substitute cast-iron boxes for bronze in the general line of machine tools, we will have to improve our methods of lubrication. It is not enough to merely squirt oil into a hole or onto a journal and allow it to drip or fly off, but we must find some method of retaining the lubricant where it will do the most good for the longest time.

EDMUND S. WILLIAMS.

Bridgeport, Conn.



AN INDICATOR FOR THE MILLER

Issued Weekly by the

Hill Publishing Company

JOHN A. HILL, Pres. and Treas. ROB'T MCKEAN, Sec'y.

505 Pearl Street, New York.

Correspondence on mechanical subjects solicited and paid for. Name and address must always be given—not necessarily for publication.

Subscribers can have address changed at will. Give old and new addresses.

Subscription price $4 per year, postage prepaid, to any post office in United States, United States possessions and Mexico. $5.50 to Canada. $7 in all foreign countries except Europe and British possessions in Eastern Hemisphere.

Hill Publishing Co., Ltd., 6 Bouverie St., London, E.C., will serve all subscriptions for English Edition for Europe and British possessions in Eastern Hemisphere. Price 30 Shillings for England. For all other countries in Eastern Hemisphere, 35 Shillings.

Published in the German language under the name of "Maschinenbau," by the Hill Publishing Co., A. G., 71 Unter den Linden, Berlin, N. W. 7. Price for Germany 24 M., Austria 29 K., Switzerland 32 Fr., other countries in Eastern Hemisphere 35 M., North or South America 40 M., or $10.

Entered at New York Post Office as mail matter of the second class.

Cable Address, "MACHINIST," N. Y.

CIRCULATION STATEMENT

During 1910, 1,488,400 *copies. For February,* 1911 *(American weekly, American monthly, English weekly and German weekly), total,* 121,000.

Of this issue 26,250.

None sent free regularly, no returns from news companies, no back numbers.

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American Machinist

A Phase of the Patent Question

The status of the inventor and his patent was clearly defined by Judge Noyes in his recent decision regarding the Selden patent. Many seem to forget that the public has any rights whatsoever in return for the granting of a 17-year monopoly to the inventor or that it expects a general benefit to the community from the use of the invention as a return.

In cases where the issue of the patent is deliberately delayed, its real life is extended without a corresponding benefit. And where, as is too often the case, patents are carefully laid away in the patent "morgue" without being used and without anyone else being able to use them—the community receives no benefit in return for its grant of a monopoly.

No one would deny the inventor a full reward for his labors, which he does not always receive under the present method. But the contract is not one-sided and the benefits arising from all patents should be available to at least such of the community as can pay the price of the machine or other device. In fact, many feel that the inventor would fare much better on the average, if some such means were provided to allow worthy devices being used in all cases, and to make side-tracking them, practically impossible.

F. W. Taylor and the Steel Mills

We hope that many readers of the AMERICAN MACHINIST have seen the *American Magazine* for March, and especially that they have read and contrasted two of its articles—one by F. W. Taylor on "The Principles of Scientific Management," and the other by John A. Fitch on "Old Age at Forty"—"an exact account of the terrible strain put on workers in the steel industry."

We have seldom seen such a perfect case of mutually destructive criticism nor such an opening for the deadly parallel.

Mr. Taylor's article tells a doleful story of the deliberate slothfulness of the American workingman, while Mr. Fitch gives an equally doleful account of the heartless manner in which he is overworked. Mr. Taylor details with elaborate care the hopeless incapacity of the older system of factory management to produce reasonably efficient workmen, while Mr. Fitch details, with equally elaborate care, the manner in which that system has become one of "speeding, unceasing and relentless, seldom equaled in any industry at any time."

The two articles are the more noteworthy because both draw their illustrations from the same source—the steel industry. True, Mr. Taylor's primary illustrations are from the machine shop of a steel mill, but he specifically states that the conditions which he describes are practically universal. For the benefit of those who have not read these articles, we give a few extracts from them.

Mr. Taylor tells us, "As was usual then and, in fact, as is still usual in most shops of the country, the shop was really run by the workmen and not by the bosses. The workmen together had carefully planned just how fast each job should be done and they had set a pace for each machine which amounted to about one-third of a good day's work.

"'Soldiering,' as it is called in this country, 'hanging it out' in England, 'ca canny' in Scotland, is thus almost universal in industrial establishments.

"When to soldiering is added the natural inefficiency, ignorance and wastefulness which characterize many, if not most of the common operations of industrial establishments, it will be seen in what a deplorable state modern industry finds itself."

On the other hand, Mr. Fitch tells us: "After nearly a year spent among the Pittsburg steel workers in 1907 and 1908, three phases of the labor policies of the steel companies stand out in my mind as overshadowing all others; they are the factors that enter most deeply into the lives of the men: a daily and weekly schedule of hours, both shockingly long; a system of speeding that adds overstrain to overtime; and, crowning all, a system of repression that stifles initiative and destroys healthy citizenship.

"By these methods the steel workers have been speeded as workmen seldom are. It is not entirely due to the marvelous ingenuity of American engineers that steel production has increased at such a remarkable pace. There is a human element in large outputs that does not appear in statistics of tonnage. The steel companies know just the relation between this human element and the tables of statistics, hence the "pushers," the fostering of foolish rivalries, the orgy of overtime in the "record months," the buying of men's better judgment in the bonus system, and the play upon human necessity in the cutting of the tonnage rates. The result of it all is a system of speeding, unceasing and relentless, seldom equaled in any industry at any time."

As if to add to the aptness of the comparison Mr. Fitch gives a description of

the system of management which has led to this result, which Mr. Taylor could scarcely improve as a description of what he calls the old type of management, which he names the system of "initiative and incentive" and from which the "deplorable state" of inefficiency which he pictures has resulted.

The explanation of this anomaly is very simple. The conditions which Mr. Taylor describes (we are bound to believe correctly) prevailed at the Midvale Steel Works when he was employed there 30 years ago, before the name or the thing now called intensive production had been born. Placed in a go-as-you-please environment, with which he made a heroic struggle, he assumes the condition of things which he found to be both universal and perpetual.

We know but little of the conditions that prevailed in the steel industry 30 years ago, or that prevail there now. But of conditions in machine shops, both then and now, we do know something, and the present conditions are as far as possible removed from those described by Mr. Taylor. To an observer of such places nothing is more striking than the quickening of the pace at which the work is done. Compared with the same place today the machine shop of 30 years ago was a place for peaceful meditation and an abode of silence.

To the movement toward intensive production, Mr. Taylor has been a leading contributor through his invention of high-speed steel, but not otherwise. As a reformer of factory management it is in the machine shop that he is best known, it is to the machine shop that he has particularly addressed himself, and it is precisely in the machine shop that he has made but little progress, and that his methods are looked upon with suspicion and distrust. The movement toward intensive production has been nation wide. Except always by his invention of high-speed steel, Mr. Taylor has contributed to it but little.

The demonstration of the unsoundness of his theories and of the fallacy of his argument is complete in the showing by Mr. Fitch that, under the old system of management, which Mr. Taylor condemns as incapable of good results, the pace, in an entire and vast industry, has been quickened even to the pace that kills.

Standardizing Safety Devices

In another column we notice briefly the appearance of the first number of the *Journal of Industrial Safety*. In making its bow it says: "Far more significant is the possibility of such a journal being a clearing house or method of distributing among all interested the knowledge of devices to diminish accidents, which have been installed in the works themselves." Dr. F. R. Hutton, president of the Industrial Safety Association, of which this journal is the official publication, referring to the association and its work when speaking to representatives of the technical press stated in substance, that one of the great fields of usefulness upon which the association expected to enter was the codifying of rules for safety and standardizing safety devices. At the last monthly meeting of the American Society of Mechanical Engineers, a similar idea was advanced, in a suggestion—upon which no action was taken—that a committee of that society be appointed to standardize safety appliances and distribute information in regard to them.

We are disposed to believe that this work can be better done by the Industrial Safety Association than by the American Society of Mechanical Engineers and are pleased at the present trend.

There are great constructive possibilities for good in determining upon approved safety appliances for points of danger that are common in industry and in formulating rules of procedure that will call attention to common hazards. If the recommendations are accepted as authoritative and put into general use in the industries of this country, a workman in moving from one shop to another will find about him familiar safeguards and will not have to undergo a probationary period with perhaps increased danger. All of the arguments commonly urged in favor of manufacturing standardization apply here and do not need to be repeated.

From another point of view the adopting of devices approved and recommended by the association, tends to relieve a manufacturer from the vagaries of factory inspectors, which are not unknown today, in which the devices approved by one may be deemed inadequate by his successor.

New Publications

THE JOURNAL OF INDUSTRIAL SAFETY, February, 1911, Volume I Number I; 20 6x9-inch pages. Published by the Industrial Safety Association, 29 West Thirty-ninth street, New York City.

This is the first issue of the official journal of the Industrial Safety Association and we welcome it to a place among the publications of engineering societies and affiliated organizations. This number contains a salutatory by Dr. F. R. Hutton, president of the Industrial Safety Association, several articles describing safety attachments or devices from the collection of the American Museum of Safety, and a list of members of the association and a brief bibliography. The devices illustrated are a safety lock for main steam valves, a safety attachment for ladders, a safety lock for crane hooks and a safety pinch bar. The publication has entered a wide field of usefulness and one in which it deserves success.

VOLUMES 4 AND 5 OF THE BULLETINS OF THE ENGINEERING EXPERIMENT STATION OF THE UNIVERSITY OF ILLINOIS. Published by the university at Urbana, Ill.

These bound volumes preserve for easy reference the bulletins issued by the engineering-experiment station of the University of Illinois during the period September, 1908, to December, 1909, both inclusive. Volume 4, containing bulletins Nos. 27 to 34, both inclusive, covers the period from September, 1908, to May, 1909; while volume 5, containing bulletins 35 to 42, both inclusive, covers the period from July, 1909, to December, 1909. We have frequently commented upon the excellent work done by this experiment station, and welcome these bound volumes as preserving in permanent form many experimental data of great value.

Cincinnati Meeting of the Metal Trades Association

The annual meeting of the Cincinnati branch of the National Metal Trades Association was held Thursday, March 2, with a dinner in the evening at the Business Men's Club. It was attended by about 200 manufacturers and superintendents, including some 40 visitors from Chicago and other cities. At the annual election that followed, Henry Ritter, of the Lunkenheimer Company, was elected president, to succeed Richard K. LeBlond. Among the speakers of the evening were J. H. Schwacke, president, National Metal Trades Association, Dr. John William Lloyd, D. C. Buell, H. H. Rice, W. H. Vandervoort, R. S. Alter and William Lodge. On Thursday and Friday the visiting manufacturers were taken in automobiles to the Oakley and other shops, the Continuation School and the University of Cincinnati.

Personals

Edward T. Adams, formerly of the gas-engine department of the Allis-Chalmers Company, has been elected president of the Wisconsin Engine Company, Corliss, Wisconsin.

J. W. Bourn, for the past eight years with the George V. Cresson Company, has left their employ in order to become superintendent of buildings for the Curtis Publishing Company, Philadelphia, Pennsylvania.

H. B. Van Pelt, connected with the Standard Tool Company in the capacities of purchasing agent and advertising manager during the past 10 years, has resigned in order to take charge of the Cleveland sales office of the Pittsburg Shafting Company, of Detroit, Michigan.

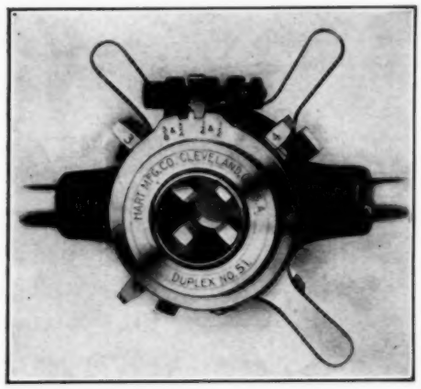
Shop Equipment News

ANY and all new or improved machines, tools or shop appliances of interest to men responsible for results in machinery-making plants will be briefly illustrated and described here — the machine shop news.
A more full and detailed description will be given — when it is real news — if it can appear here first — before it is sent to other papers. ALL descriptions appear in ALL four editions of the paper—Weekly, Monthly, Weekly English and Weekly German

A Pipe Die Stock

The halftone shows a new stock which is being put on the market by the Hart Manufacturing Company, Cleveland, Ohio.

One end of the chasers is threaded 18



A Pipe Die Stock

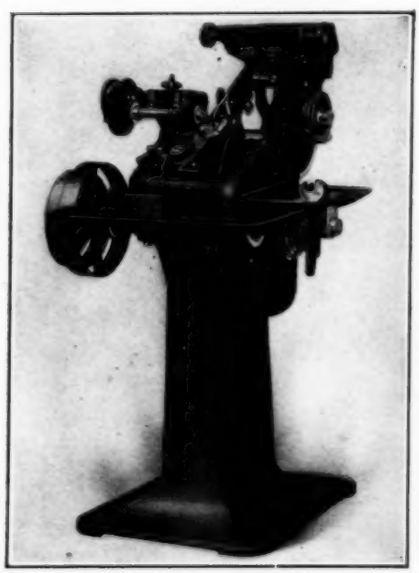
per inch suitable for ¼- and ⅜-inch pipe, the other end being threaded 14 per inch for ½- and ¾-inch pipe. The variation in size is obtained by the cam and stop. In this way four sizes of pipe may be threaded by this single set of double-ended chasers.

An Automatic Screw Slotter

The halftone shows a new machine which has been put on the market by the Waterbury Farrel Foundry and Machine Company, Waterbury, Conn.

The machine is arranged so that the chips and finished blanks are delivered into separate receptacles.

Provision is made to allow the machine to operate at the speed which is most suitable for the particular screw to be slotted—the power for driving the saw being obtained through a belt from the countershaft to a pulley 4 inches in diameter by 1½ inches face which is geared 3 to 1 to the saw spindle for steel work, while for brass work a pulley of the same size is located on the saw spindle itself. The hopper feeding mechanism is provided with simple adjustments to adapt the machine not only for work which is done in long runs but as well for short runs. To shift from one size blank to another it is necessary to replace two pieces only. The machine handles blanks with short shanks equally as well as those with long shanks up to the capacity which is 1½ inches long under the head. The largest diameter of shank allowed is ¼ inch. Blanks having a length of shank equal to one diameter have been successfully fed by the hopper and slotted in the machine.



An Automatic Screw Slotter

A Tool Post

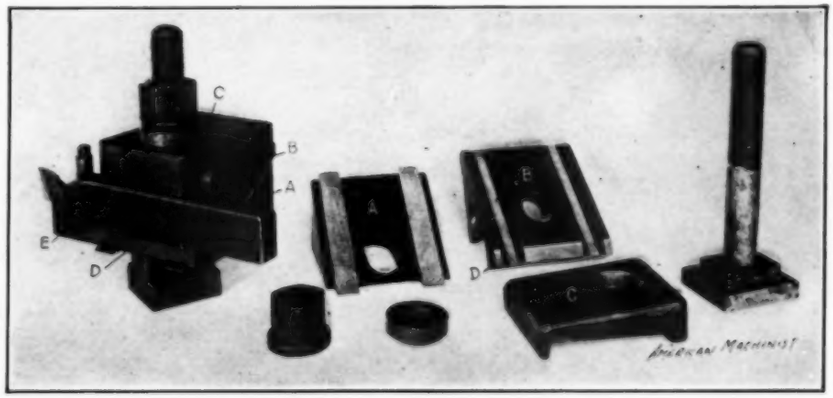
The halftone shows a new tool post which has been brought out by the O. K. Tool Holder Company, Shelton, Conn. The holder is shown assembled to the left and disassembled to the right.

The base *A* is provided with two toothed tongues which fit in slots in *B*. The bottoms of the slots in *B* are provided with teeth which engage the teeth in the tongues on *A*. The member *B* is provided with a shelf *D* upon which the tool *E* rests. A cap *C* clamps the tool *E* firmly when the nut is tightened. By slackening the nut and sliding the member *B* diagonally on the base *A* the tool can be adjusted to any hight desired, the teeth retaining the members *A* and *B* firmly in position.

The tool post is very compact and solid, is made of forged steel and is pack hardened throughout. It is adapted for heavy work.

Refractory Cements

The H. W. Johns-Manville Company, of New York, are now offering to the trade a line of cements called J-M refractory cements for the following purposes: Furnace setting of various types;



A Tool Post

cupolas; lining brass furnaces; assayers crucibles; oil burning, tilting and rotary furnaces; and for patching and facing bricks in place in the fire zone under various conditions. These cements are rated to resist temperature as high as 3000 degrees Fahrenheit. They have also produced a coating for walls known as J-M brickline cement, which prevents clinkers from adhering and to seal the pores of the brick.

A Portable Swing Frame Grinder

The halftone shows an electrically driven grinder built by the Safety Emery Wheel Company, Springfield, Ohio. The machine is mounted as shown on a pair of steel wheels 42 inches diameter. It can be furnished mounted on a trolley suspended from an I-beam or equipped so as to be handled by a traveling crane.

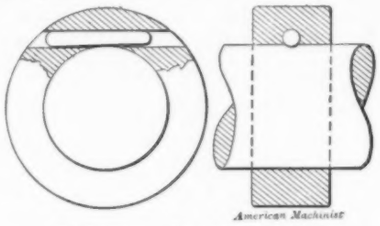
The machine carries an abrasive wheel 24 inches diameter by 2 inches thick when using safety collars or 3 inches thick when these are not used.

The spindle is 2¼ inches diameter in the wheel and 2 inches diameter in the bearings which are 5¼ inches long.

The motor is 5 horsepower and the belt is 5 inches wide. The machine complete weighs 1800 pounds but is perfectly balanced so that one man can handle it easily. As shown the motor and wheel head are supported at opposite ends of the shaft. This shaft is free to swing in the bearing on the axle but is retained in balance by an adjusting screw which takes care of any variation in balance due to the wearing of the wheel.

A Safety Shaft Collar

The shaft collar shown in the accompanying cut has recently been placed on the market by Fa. Hermann Howey, Magdeburg-S, Germany.



A Safety Shaft Collar

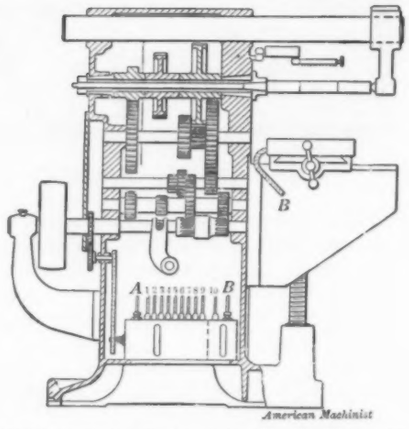
The collar has a taper hole tangent to the bore, into which a taper pin is driven to clamp it to the shaft.

Forced Feed Lubricators for Machine Tools

The J. L. Osgood Lubricator Company, Buffalo, N. Y., is placing on the market a system of valveless forced-feed oilers for machine tools. The line cut shows the application of the system to a milling machine.

In this case the oil tank is divided into two compartments—one for lubricating and the other for cutting oil. The delivery pipes 1 to 9 lead to the various shaft and gear bearings. The pipe *A* is the return drain from these bearings. Pipe 10 connects with the delivery pipe for the cutting oil and pipe *B* is the return for cutting oil from the table.

A circulating pump is mounted in the tank and driven by chain belt from the main shaft of the machine. In action it is automatic, starting and stopping the oil supply as the machine is started or stopped.



Application of Lubricator to Milling Machine

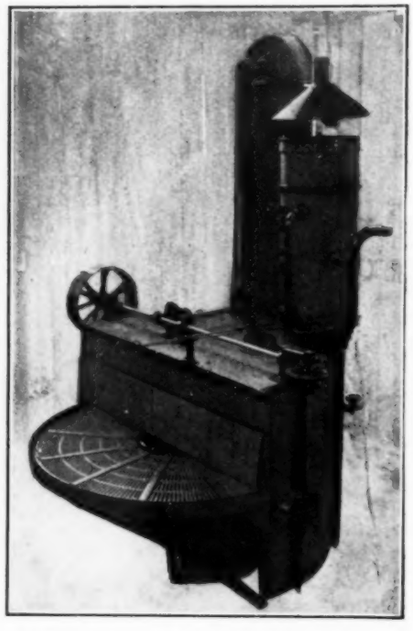
A Continuous Sand Blast Machine

The halftone shows a new sand blast machine built by Vogel & Schemmann, Kabel i. Westfalen, Germany.

It has a rotating table provided with openings through which the sand can fall to the receptacle below from which it is elevated to the sand reservoir. The work is placed upon this table and after passing the guard is exposed to the action of the sand blast. Having passed the blast it is carried past the guard at the other side of the machine and is removed by the operator.

With this type of machine the ducts for air and sand are comparatively short and the operator is not exposed to the effects of the sand.

A Portable Swing-frame Grinder



A Continuous Sand-blast Machine

A Lathe Tool Testing Plant

Editorial Correspondence

A complete lathe tool testing plant where anyone who thinks he has a good lathe tool can test its efficiency.

The O. K. Tool Holder Company, Shelton, Conn., has installed at its plant a testing outfit shown in Fig. 1, consisting of a powerful motor-driven Whitcomb-Blaisdell lathe, a watt-meter to show the power consumed, a Warner cut-meter and a platform scale to weigh the chips.

The testing outfit is practically open to the mechanical public. As put to us by the superintendent: "We think we have the best steel for lathe tools, and this plant is to show what it will do, but if anyone has a better, or a way of treating steel so that it gives better results than our present methods, we want it, and are willing to let him test what he has right here at our expense."

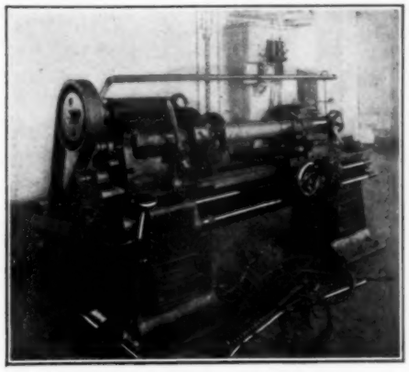


FIG. 1. THE TESTING OUTFIT

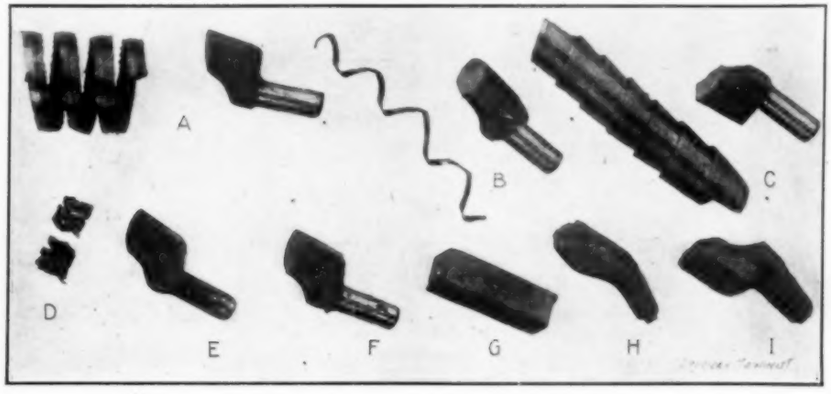


FIG. 2. SOME OF THE TOOLS AND CHIPS

In a test recently run on nickel steel, machine steel, and cast iron, some exceptionally good results were obtained with regular tools taken from stock. These tools were made of O. K. steel which is a special high-speed steel made in Sheffield, England, for the company.

Considering the amount of stock removed and the speeds used the holder, 5/8x1 1/4 inches, was comparatively small, but as large as the tool post of the lathe would accommodate. Two types of tools only were used; that shown at *A, B, E* and *F*, and the flat-nose tool shown at *C*, Fig. 2. The angles and clearances are those found best for all-round work on the materials mentioned. No doubt better results could have been obtained by changing the angle slightly to suit each material but this was not done, as it was thought best to show just what the stock tools would do.

The first bar put in the lathe was a piece of 40-carbon steel, 6 inches diameter. In order to true it up a feed of 0.1 inch at a speed of 175 feet per minute with a reduction of 3/16 inch was used. This cut consumed 10 1/4 horsepower, and owing to the heavy scale the tool played out after turning a foot of the bar.

The speed was then reduced to 125 feet with the same feed and depth of cut, and no further trouble was encountered, the tool, in spite of the scale, being in first-class condition at the end of the cut. The speed was again reduced to 115 feet per minute; feed 0.1 inch, 1/4 inch deep. Under these conditions 12 horsepower were consumed. The chips were blue and the tool ran at a dull red. The length of run was 3 minutes and 10 seconds, and 18.5 pounds of chips were removed in that time. The chip and tool are shown at *A*, Fig. 2, the edge of the tool is in excellent condition, but the chip wore a groove in the top face of the tool just back of the cutting edge.

The next run was a finishing cut 1/32 inch deep, 20 per inch feed, at 250 feet per minute. Nearly 3 horsepower was consumed, the chips were brown and it took about 2 minutes to finish 18 inches of the bar, which by this time was approximately 5 1/4 inches diameter. The chip and tool are shown at *B;* the edge of the tool is perfect and the discolora-

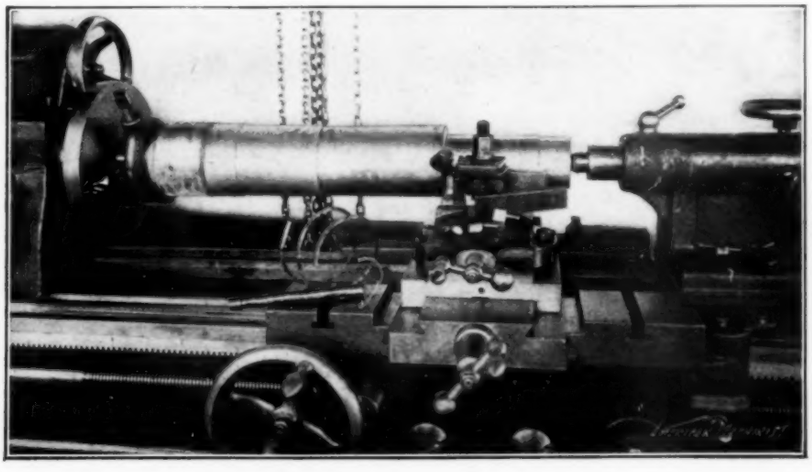


FIG. 3. FORTY-CARBON STEEL TEST BAR, TOOLHOLDER AND TOOLS USED

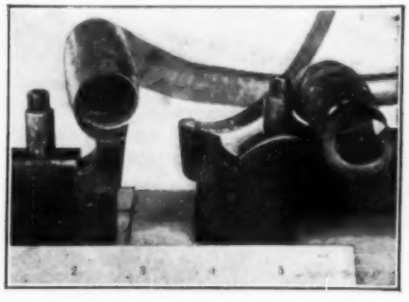


FIG. 4. TWO TOOLS WITH CHIPS WELDED FAST

tion due to heat is very slight. Apparently the tool would have run indefinitely at the same rates of speed, feed and depth of cut.

A broad flat tool, as shown in cutting position, in Fig. 3, was then tried on the same piece of 40-carbon steel. The speed was 150 feet per minute; reduction 1 5/16 inches, with a feed of 52 per inch. In this test from 12 to 13 horsepower was consumed, the chips were dark yellow and the tool ran red hot. The duration of cut was 3 minutes, and in this time a little over 18 pounds of stock were removed. The chip and tool are shown at *C*, Fig. 2.

The next test was on soft cast iron. The speed 170 feet per minute; ¼-inch reduction; 1/10-inch feed; power consumed 12 horsepower; duration of cut 30 seconds; metal removed 8 pounds, equal to 16 pounds per minute. The tool and cuttings are shown at *E* and *D*, Fig. 9.

The same material was again cut, but the speed increased to 180 feet per minute; 15/16-inch reduction; 6 per inch feed; power consumed 16 horsepower. The cut ran for about 1 inch, when the lathe stalled owing to the belt slipping on the small motor pulley. The feed was then reduced to 8 per inch; at this feed the speed and reduction being the same, 13¼ horsepower were consumed and 18 pounds of chips were removed per minute. The tool is shown at *F*, Fig. 2, and was in excellent condition at the end of the cut.

A striking feature of the tools made of O. K. steel is their uniformity. On one test on 30 carbon steel, at a cutting speed of over 500 feet per minute (the cut meter registered to 500 feet only), reduction of 1/16 inch and a feed of 40 per inch, three other makes of high-speed steel tools were first used. The test bar was 6 inches diameter. The first ran ⅜ inch before breaking down, the second broke down immediately, and the third ran about ¼ inch. The O. K. steel tool on this test ran for three inches before failing and two other O. K. tools ran 3⅛ inches and 2⅞ inches respectively.

On 3½ per cent. nickel steel the O. K. tool carried a cut 5/16 inch deep, 52 per inch feed, at 62½ feet per minute.

G, *H* and *I*, Fig. 2, show respectively the blank for an O. K. tool, the first hydraulic forging under 50 tons pressure and the final hydraulic forging under 70 tons pressure. It is said that the high efficiency of the tools is in a great measure due to this method of compressing the steel, it having been found that a tool forged in the ordinary way from the same steel will not stand up as well as the hydraulic forged tool.

Fig. 4 shows two tools, the broad flat tool to the left and the roughing tool to the right. A piece of 3½ per cent. nickel steel was being cut and the lathe was stopped without withdrawing the tools. The chips and tools were so hot that they welded together and yet the edges of the tools appear to be in good condition.

An Automatic Feed for Blanks Having One Beveled Edge

By W. Young

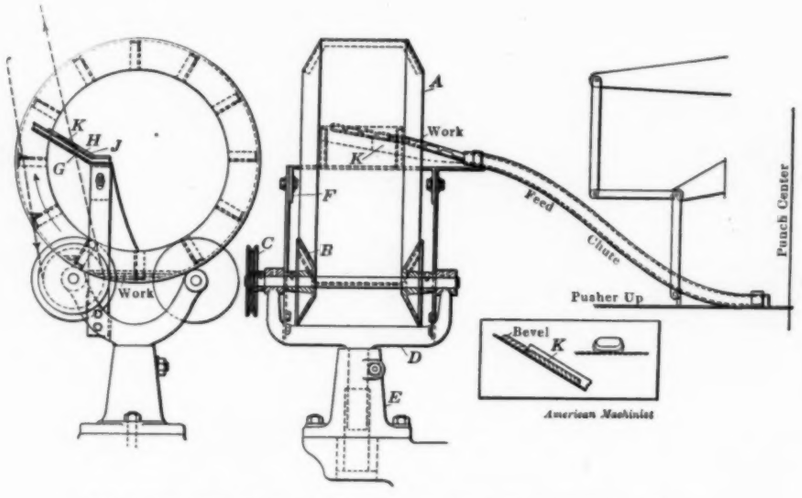
The apparatus consists of a slowly revolving drum *A*, into which the work, such as side plates for links, is placed, the brackets *D* and *E* carrying it. The rollers *B* support and impart rotary motion to *A*. The plates and strips *G*, *H* and *J* form the "self sorting" feed slides.

E is fixed to the table of the press or to any suitable support, and is arranged to swivel for adjustment purposes. It carries *D*, which forms bearings for the shafts of *B*, and is adjustable for hight, being clamped in position by a bolt. The rollers *B* may be either of wood or of cast iron leather covered, the one pair of rollers acting as drivers while the other pair support and keep the drum in position. Rotation is obtained by means of a pulley *C*, adapted for round belt and driven from the countershaft of the machine.

A is made of sheet iron or steel, strengthened by angle irons, the latter also acting as shelves for carrying the work around, the operations being as follows:

A being charged with pieces (merely thrown in), and the machine started, *A* slowly revolves, the shelves carrying the pieces around until at the hight of the inclined plate *H*, gravity causes them to fall onto *H*. Attached to *H* is another inclined strip *J*, down which some of the pieces slide, a quantity, of course, always falling to the bottom of *A* again. At the point *K* the strip is cut away, as shown in end elevation and enlarged view, leaving a thickness only sufficient as a bearing for the pieces should they be the right way up, that is, with the beveled edge outward. Should the beveled edge be inward, against the slide, then, at *K*, the piece slips off and drops to the bottom of the drum again. Thus the mechanism sorts its own work and the pieces passing *K* gradually change from an inclined to a horizontal position and are conducted to the chute or pocket down which they proceed in single file, dropping one by one as required at each stroke of the machine. The pusher up for the final location of the piece under the punch can either be operated by bell-crank lever from an arm on the pitman, as shown, or other suitable means.

In order to facilitate the setting up of the feed mechanism, it being necessary to adapt the various inclines to each other, the frame *F* is adjustable about its axes and also for hight in relation to the drum, being finally clamped in position by means of the bolts shown.



An Automatic Feed for Blanks Having One Beveled Edge

The above appliance will show a considerable saving over the usual method of sorting by hand preparatory to filling the feed chute.

Recording Indicator for Punching—Erratum

I note your reproduction of my article on "Recording Indicator for Punching," at page 304, from the advance papers of the American Society of Mechanical Engineers. I regret that one mistake has occurred in the tables which may cause confusion. Column 3 of Table 1 and Column 5 of Table 2 should read: *Maximum Stress*, and not "Maximum Stress, Pounds per Square Inch.

Gardner C. Anthony.
Dean Engineering School, Tufts College.

Safeguards for Punches and Dies*

By Oberlin Smith †

An analysis of punch press hazards and safety devices. The only safe rule for operation is: Never put fingers, hands or arms between the dies.

*Discussion of paper presented to American Society of Mechanical Engineers on the Mechanical Engineer and Prevention of Accidents.

†President, Ferracute Machine Company.

In this discussion, I will limit myself to that most dangerous and most bloodthirsty class of implements known as presses and dies, it so happening that I am especially familiar with their doings and misdoings.

The first kind of danger incident to these machines, and one which threatens people in general moving about a shop, rather than the operator only, is obviously the chance of being drawn in by belts and gearing. This can be obviated by guards arranged in any of the ordinary ways, some of which are shown by Mr. Calder.

Gear Accidents and Guards

In an experience, however, of some 40 years with these machines, I have known but few accidents of this kind. In my own practice I have not equipped presses with complete guards unless especially ordered and paid for by the customer, but a partial guard has always been placed between each pair of gears on the in-running side. This guard consists of a casting somewhat wider than the face of the gears, extending from the point of tooth contact through a considerable arc in the form of curved plates nearly touching the teeth. This has seemed to serve almost as good a purpose as guards running entirely around the gears and is not prohibitive in cost when included in the price which buyers will pay.

Accidents to Fingers and Hands

The next and most usual kind of accident pertaining to a power press is the mashing or shearing off of fingers and hands by being between the dies when they come together. This often occurs by pure carelessness on the part of the owner of the fingers. In cases where he lets the ram of the press run continuously and trusts to luck, and to a certain acquired automatic rhythmic movement of his hands, to avoid accident, any mental disturbance of the rhythm, as a sudden movement or noise in his vicinity or a desire to look around for something happening in the street, may prove disastrous. Of course, this cannot occur if the machine is arranged as it should be, so that his fingers cannot possibly go between the dies.

A more frequent accident occurs when the ram of the press is allowed to stop between each stroke by the action of the automatic stop-clutch generally embodied in these machines. Each operation consists in placing the work between the dies and then depressing the treadle (or in some rare cases a handle) which throws the clutch into mesh so that the continuously revolving flywheel operates the shaft through one revolution and then stops it. This performance is safe even if the fingers have been between the dies, *providing* they are taken out before the treadle is depressed and not put in again until the ram is surely stopped in up-position. It often happens, however, especially with piece work, that the treadle is depressed almost immediately after the ram is stopped so that again there is needed a rhythm common to the finger motions and the halting continuity of the ram motion.

Under these conditions it is probable that most of the accidents happen because the treadle is not allowed to rise entirely to its upper position, far enough, that is, to positively insure the stopping of the ram. In such case it comes down a little sooner than is expected. This premature motion, if not followed by the fingers, may leave some of them in the dies. A remedy for this evil has been devised by the writer and some other press makers in the shape of a device by which the clutch-lever detaches itself from the treadle action, each time the latter is depressed, by means of a cam upon the main shaft, which itself performs the stopping action of the clutch. This, if kept in order, will provide safety and is a valuable device, but customers usually are not willing to pay for it.

A similar trouble may happen by the clutch being out of order so that the treadle and tripping device (often known as a clutch lever) do not rise as promptly as they should, owing to the binding of some parts, or the weakening of springs which, perhaps, have not been kept in proper adjustment. An occasional trouble causing the ram to descend unexpectedly is the "cutting" or "seizing" of the flywheel, or gear upon the shaft. This, of course, is due to the lack of oil, or the presence of dirt, or both between the wheel and the shaft. Nothing but correct automatic lubrication would seem to be an approximately absolute cure for it; and this is not usually applied to presses.

The Only Safe Rule for Press Operation

The cases are rare where fingers are deliberately placed between dies and then the machine prematurely started, but even this happens sometimes. The only safe rule to follow, as a preventive of all the different kinds of accidents above referred to, is *to never* put fingers, hands, or arms *between dies*, while the flywheel or gearing of the press is in motion, even though the clutch may be fastened out of action by a clutch lock (such as I have devised and always used). And, further, never place the fingers between the dies when nothing is in motion, without putting a block of some kind under the ram, or between the dies so that the ram cannot possibly descend by its own weight, or from other causes. Instead of such block a "safety post" might be made which could be swung up or forward underneath some part of the ram when not in action.

In cases where hand feeding is practised, a positive rule against such putting in of fingers is difficult to enforce. The employees do not like it because it sometimes lessens the speed of feeding and the workmen dislike it for the same reason, when practising piece work, or when expected to perform a given task. Even if ordered to thus protect themselves they often disobey simply from recklessness.

It would seem from the above facts that particular attention should be given to developing protective devices in and about the dies. This is done in many kinds of work but it is difficult to make any general attachment to a press that will meet all the very numerous conditions attending to work done therein. Of course, the dangers alluded to can be almost absolutely eliminated when strictly automatic feeds are used.

Press Feeds

Considering first, primary operations, as the working of cutting (punching or shearing) dies, the most usual feeds are:

(*A*) Single or double roller feeds, where the flat sheets or bars of metal or other material are held by spring pressure between intermittently revolving rollers; also,

(*B*) Reel feeds, where flexible metal or other material in strips is pulled through the dies from one reel with a brake upon it by another intermittently revolving reel upon which it is rewound; also

(*C*) Grip and push (or pull) feeds, generally made with a pair of stationary grippers and a pair of reciprocating sliding grippers, these latter alternately gripping the edge of the material and carry-

ing it through the dies any desired distance at each stroke of the press; also

(*D*) Gravity feeds, where the press-ram axis is inclined at an angle to the vertical (perhaps even to a horizontal position) and the material descends by gravity against a let-off gage, placed back of the dies, working automatically. All of the above can easily be protected.

Concerning feeds for second operations the most usual kinds are:

(*E*) Dial feeds for redrawing, forming, curling or repunching work. A common well known form consists of an intermittently rotating disk in the respective apertures of which the work is put by hand at the front of the press, far away from the dies, and is carried around until it reaches them—in some cases a group of dies performing successive operations upon it; also

(*F*) Friction-disk feeds, where the articles are pushed from a table onto a flat revolving disk which carries them by friction between certain fences or guides and which delivers them under the dies. They are stopped by a let-off device to limit the motion of each one as it arrives in final position; also

(*G*) Push feeds, where a sliding carrier comes forward to receive the work and then carries it back between the dies again, coming forward for another piece; also

(*H*) Tube feeds, used especially for small articles like coins, medals, etc., which are piled upon each other in a tuoe and allowed to descend by gravity so as to be fed to the dies by anyone of the three previously described methods, *E*, *F* and *G*, usually, however, with the latter. Feeds *F* and *H* are almost absolutely safe against hurting the fingers, while with *E* and *G* there is some little danger of getting the fingers in the feeding device itself, if they are not quickly enough removed before it starts; they cannot easily, however, be carried back to the dies. When devices of this sort are used by stopping the press at each stroke while the work is being placed in the dial, or carrier, absolute safety is assured.

Hand Feeding

Returning to the consideration of hand feeding. With thin metals, mere cutting operations can be made entirely safe by using a proper stripper surrounding the punch. This should fit very close to the punch and come down as nearly close to the top of the die as possible to allow the metal to go between and should be quite thin so as not to obstruct the view of the work outside the limits of cutting. It should also be so high that the punch at the top of its stroke never comes entirely out of it, thus giving no chance for fingers to be put in above it.

With thick metals, the stripper, obviously, has to be placed so high that fingers can be put in under it if anyone is foolish enough to do so.

In the case of forming, repunching, etc., where small objects must be located between the dies and sometimes a considerable distance in from the front thereof, it is nothing but criminal to allow the operator's fingers to ever go between. The inserting and removing of the work should always be done with a stick of pine wood, or some other soft material, which will not damage the dies if they happen to come down at the wrong time and which is not so costly as thumbs and fingers.

In general, where hand feeding is resorted to, there is no universal panacea for the evils in question. A careful attention to all of the points above mentioned, however, will reduce the percentage of danger to a very small figure, especially if there is any such rigid discipline, backed up by both altruistic and financial motives, as will absolutely prevent any fingers being put between any dies. It may be stated that in any ordinary press shop where thousands of different kinds of work are to be done, and perhaps only small batches of a few thousand, or a million or two, pieces are to be made, it is very expensive to provide all of the different kinds of automatic feeds and guards that would be needed for the much varying kinds of work. If, however, we should get our much desired uniform State laws providing reasonable penalties for the carelessness and parsimony that produce our present numerous accidents it is probable that the volume of them would greatly decrease.

I have frequently had inquiries for safety apparatus for a roomful of presses, but have always been obliged to reply that each press and each pair of dies must be considered separately, and that much expert designing would have to be done for special devices to suit each varying condition. Some of these would, of course, be simple, but others would have to be automatic in their character and, on the whole, quite expensive. Hence, not many press manufacturers have gone into this matter thoroughly, principally because they know that their competitors would not be obliged to do the same.

Illustrating Machine Details —Obtaining Due Credit

By John R. Godfrey

The question of shop or trade secrets keeps bobbing up in some form or other and there seem to be some strange ideas afloat in regard to it. One of my manufacturing friends has just brought out a machine with a new gear box for getting the 57 varieties of feeds that you rarely need but which seem to be the style, and is deeply pondering as to whether he shall allow it to be described in the American Machinist.

He is perfectly willing to have the editor discourse on its many advantages as long as the words in the English language hold out, but he is decidedly scary as to having even a photograph of the "innards" shown to the anxious world. And all because he does not want the builder who is lying in wait for good ideas to copy to grab this device with triumphant glee and proceed to wax fat on the profits accruing therefrom.

Now, from my point of view, it is a whole lot better to have the gear box illustrated, even to the point of reproducing a blueprint showing just how it works. True it makes it easier to copy but, whether patented or not, the man who wants to copy will get a chance to take a machine apart in the shop of some friend or will even buy a machine if he wants to know badly enough. He gets it in either case.

But if the real inventor publishes the gear box first, shows how it is made and tells why and how it works, that particular brand of gear box has his name fastened to it for all time. Then, when the copy comes along, all those who keep posted give it a glance and say, "Well, I see Jones has copied Smith's gear box this time." And the name of Smith is driven deeper than ever into the minds of those who have to do with machine tools.

This hiding one's light under a peck measure has resulted in more than one machine being credited to the wrong party and, though the first man is grievously hurt at credit going elsewhere, he has himself to blame.

Worcester's Fame

A publication of the Worcester Polytechnic Institute summarizes inventive and industrial achievements that have taken place within a radius of 15 miles of Worcester as follows:

Elias Howe invented the sewing machine; Eli Whitney invented the cotton gin; Lucius J. Knowles invented textile looms; Pliny Earle first manufactured card clothing; Jerome Wheelock invented the Wheelock steam engine; A. W. Gifford made the first milled machine screw; Ichabod Washburn made the first piano wire drawn in this country; Erastus Bigelow invented the carpet machine; Thomas Blanchard invented the machine for turning irregular forms; George Crompton invented the power loom for fancy cottons; Charles Thurber invented the first typewriter; Russell L. Howes invented the first envelop-making machine; Osgood Bradley established the first car works in America, still in existence; Charles H. Morgan installed the first continuous rolling mill in America; W. T. G. Morton first discovered the use of ether as an anesthetic.

Why Are Prices Not Published?

By John R. Godfrey

An electric-motor builder who does not care whether the consumer gets stuck or not.

Publishing the prices of a machine prevents overcharging and helps in other ways.

I had an inquiry the other day for prices on an electric motor, and, in order that my information might be complete and correct in every detail, I went straight to the manufacturer of a well known motor. On giving the proper grip, whispering the password and otherwise assuring them that I had been fully initiated into the mysteries of the trade, I was given a net price on a certain-sized motor. Then I asked for the price to the consumer and learned, much to my astonishment, that I was at liberty to charge him any old price I desired. In other words, there is no retail price on their motors, but any dealer can size up his customer and make his price in accordance with the size of his pocketbook or his ignorance on the subject possibly.

Not being a graduate of the schools of high finance in the vicinity of Wall Street, it is just possible that this may be a good way of doing business and that I do not recognize it. But it takes me back altogether too forcibly to the days when there was no fixed price on ready-made clothing, and to one instance in particular when my neighbor bought a suit of clothes exactly like mine, and at the same store, for about 25 per cent. less than I paid. Such methods of doing business are fast being done away with, even in the clothing trade, and why it should be permitted in one of our newest industries, which has had the advantage of all the experience that has gone before, is something of a mystery to me.

Needless to say, I did not buy that particular make of motor, because I had the uneasy feeling that the next man probably got an even better trade price than I did and that my customer stood a good chance of getting stuck anyhow.

Where the Machine-tool Men Stand

I do not believe there is a single reputable firm in the machine-tool industry which would tolerate such a condition of selling machinery. No matter whether machines are sold through dealers or not, there is in nearly every case a fixed price to the consumer, usually given f.o.b. at the point of manufacture.

There have been cases where the dealer has added to the retail price of the machine in order to increase his commission for handling it. But it is very seldom sanctioned by builders, as it is sure to reflect on them sooner or later. When a man finds that he has paid, say $100 more for a boring machine than he could buy one for direct, he is not apt to be in a very amiable frame of mind in regard to it, and he very seldom stops to blame the dealer, but holds it against the manufacturer of the machine. This is one of the reasons why some manufacturers are doing most of their selling direct.

It is to the credit of the machine-tool industry that most of its products are sold at a fixed price, which is not varied under any circumstances. While it takes considerable nerve to refuse an order at a small discount, especially when the shop is not particulalry busy, there are more and more manufacturers who are acquiring this kind of nerve and who deserve great commendation for it.

Why Are Prices Not Published?

This brings up another question which it seems to me might very well be considered by machine-tool builders. Why should the prices of any standard machine be such a mystery as they seem to be in many cases? I could name a dozen concerns, and there are probably hundreds more, who have fixed prices for their machines and who would not consider a cent less, regardless of who the purchaser is or of how many machines are already in use in his shop. These men take what I believe to be the correct attitude, that their machine is worth all that they ask for it; that they are benefiting the customer who buys it as much as the customer is benefiting them by his order; and that they are just as much entitled to an extra price on additional machines as the buyer is to a discount.

These men have only one price, which they are perfectly willing to quote to any prospective customer, and yet there are mighty few who have the nerve to advertise the price or even to put it in their catalogs. Of course, the objection to a price catalog is that the prices may change before the catalog is destroyed, and considerable correspondence may be necessary to set the matter straight. But, on the other hand, prices do not change to any great extent on standard tools, and to any changes that are made attention can be called in the advertising which all uptodate firms are finding such a useful part of their business.

An Ad. That Tells Its Story

Right here I want to congratulate the Blake & Johnson Company for advertising the price of their grinder on the front cover of the American Machinist, and I fully believe that if more builders did this it would be better for all concerned.

While I would not advocate doing this in every advertisement, as I realize that it might deter some men from looking into the merits of a high-priced machine, yet I believe most men who are in the market for uptodate machinery would at least attempt to find out the reason for the high price as a matter of curiosity, if nothing else.

Unless my memory is much more wabbly than I think, the older catalogs of the Brown & Sharpe company gave the prices of their standard machines the same as of their small tools, and I cannot see why such a course would be in any way disadvantageous to them.

Knowing the Cost of Machines

I am also inclined to believe that it might not be a bad thing for the men in the shop to realize the cost of the machines they are operating. I believe any normal man would naturally take better care of a machine that he knew cost one thousand dollars than if he thought it cost but half of that amount. In fact, it has been quite common practice on some railroads to post a notice containing the price of such equipment as air-brake hose, in order that train men might see the value of such equipment and be more careful with it.

I do not believe there is any necessity for half of the mystery in regard to prices, or any reason why they should be whispered confidentially in the ear of the prospective buyer. If you believe the price to be fair, there is no reason for trying to hide it, and, as a matter of fact, your competitor is very apt to be familiar with it about as soon as your first customer.

As a means of preventing dealers from overcharging customers and of showing to the world that you have a fixed price, I would even suggest casting it into the bed in a prominent place.

Bargain-hunting Men

We laugh at our wives for hunting bargains, but I know men who are so constituted that they are not happy unless they receive some kind of a discount, even if it is only one-tenth of one per cent. As an instance of this, there is a large manufacturer in the Middle West who boasts that he never pays full price for advertising, and I can readily believe this, because he is not represented in the best papers.

As the story goes, one of the advertising solicitors of long ago got even

with this particular bargain hunter by having a special rate card printed. He then, very confidentially, of course, gave him a special price. And the bargain hunter was happy until he (also confidentially as is the custom) told a competitor of the low price he had secured, only to find out, in spite of the discount, he was still paying more than the regular rates. Then he hired an expert cuss artist to relieve his feelings in a satisfactory manner.

A Sure Means to Prevent Blisters

By J. Kirner

In chemical and metallurgical laboratories picric acid has long been used for small burns where the skin is not destroyed but blisters are to be looked for, and, according to my experience, its use is not so well known as it ought to be.

In the hardening room under my charge I have for many years furnished a small bottle of this salt and have heard no complaint against it. This "medicine" is highly prized by the hardeners for emergencies. A very particular advantage of the picric acid is that the burnt part may be cooled at leisure with water. The application is very simple. The burnt spot is moistened with water and a very little powder spread on. After hardly half a minute the salt has so far penetrated that the burnt place can be cooled in water without in any way weakening the effect of the remedy.

In case the inner skin has been burnt away, it is possible after a few hours to take hold of anything without discomfort.

It must not be forgotten that picric acid is a dangerous explosive, so it must not be kept in too great quantities and must be well guarded. However, it would be a good thing to put a bottle of it in a suitable place in every foundry and hardening room.

Rubber Stamping Tracings

A really effective and very simple method of rubber-stamping titles on tracings is to use ordinary rubber stamp, ink and pad, and brush over the impression with lampblack, using a small camel's hair brush. Care is not required, as the black will stick only to the wet ink and, moreover, the ink will not smear under the brush, as the powder dries it up almost immediately. All superfluous lampblack is removed by rubbing lightly with a piece of cotton waste. This process is suitable only for the glossy side of tracing.

Increasing Shop Capacities

News items for the sales department — where more equipment will be needed. Authentic news is solicited for this department, not rumors or gossip — facts

Metal Working

NEW ENGLAND

W. D. Clement, Waltham, Mass., is in the market for a milling machine.

The Warren Cotton Mills, Warren, Mass., is building a new machine shop.

The Royal Typewriter Company, Hartford, Conn., will double the size of its plant.

The shellac manufacturing plant of J. B. Farnum, Woonsocket, R. I., was damaged by fire.

The plant of the M. F. William Jewelry Company, Providence, R. I., was damaged by fire.

The West Haven (Conn.) Wire Novelty Company will erect two additions to its plant.

The plant of the Stoddard Jewelery Company, Arlington, Mass., was damaged by fire. Loss, $4000.

The Boston & Maine Railroad is soon to issue a list of machinery required for the Concord shops.

The plant of Scrannage Brothers, brass founders, Beverly street, Boston, Mass., was damaged by fire.

The Springfield (Mass.) Foundry Company has let contract for the construction of a new foundry, at Indian Orchard.

Fire at the plant of the Bay State Tap and Die Company, Mansfield, Mass., caused considerable damage to machinery.

The Dosch Manufacturing Company, Bridgeport, Conn., will erect a new factory. The concern manufactures light hardware.

The Boston & Maine Railroad propose to erect large repair shops on the site of the million-dollar race track, at Salem, N. H.

The Baush Machine Tool Company, Springfield, Mass., will erect an additional building to be used as extension to its machine shop.

The Massachusetts Saw Works, of Chicopee, Mass., will move to Springfield, where it has taken out a permit for a $50,000 factory.

The Cameron Car Company, of Beverly, Mass., is negotiating for site for a branch automobile plant in the South, probably Norfolk, Va.

The Berkshire Auto Car Company, of Pittsfield, Mass., is considering the removal of its plant to a location near one of the large eastern cities.

The Petow-Krieger Jewelry Company, Inc., Providence, R. I., has removed its plant from Westfield street to Page street, in order to secure larger accommodations.

MIDDLE STATES

The Cannon Box Company, Geneva, Ill., is installing a machine shop.

The Crucible Steel Company will build steel plow works, at Midland, Penn.

The Wisconsin Engine Company, Corliss, Wis., will greatly enlarge its plant.

The Foos Gas Engine Company, Springfield, Ohio, will build a $50,000 addition to its plant.

The Delaware & Hudson Railroad is preparing to erect a new roundhouse, at Scranton, Penn.

James G. Heggie, boiler manufacturer, Joliet, Ill., has been looking for site for a new plant.

The plant of the Haynes Automobile Company, Kokomo, Ind., was practically destroyed by fire.

The Celfor Tool Company, of Chicago, Ill., is considering the erection of a factory in Buchanan, Mich.

The Davis Manufacturing Company, builder of automobiles, Milwaukee, Wis., will build a $50,000 addition.

The Victor Motor Truck Company, of Buffalo, N. Y., is said to be contemplating the erection of a larger plant.

A three-story addition will be built at the plant of the Barney & Smith car works, on Keowee street, Dayton, Ohio.

The Burgess-Norton Manufacturing Company, Geneva, Ill., making hardware specialties, will build an addition.

The Chicago Pneumatic Tool Company is making improvements at its Detroit, Mich., plant, including a new machine shop.

The I. B. Rowell Company, Menominee Falls, Wis., is to erect a new plant for the manufacture of agricultural implements.

The Doehler Die-Casting Company is building a four-story addition to its plant, at Court and Ninth streets, Brooklyn, N. Y.

The Georgian Manufacturing Company, Binghamton, N. Y., will erect additions to consist of blacksmith shop and core room.

The Reading (Penn.) Iron Company has prepared plans for a new mill to take the place of mill No. 5, which is to be abandoned.

The Flat Automobile Company, Poughkeepsie, N. Y., which erected a new plant a year ago, will be obliged to build an addition.

The National Screw and Tack Company, Cleveland, Ohio, has increased its capital to $1,250,000. Some new equipment will be added.

The Alliance (Ohio) board of trade has made arrangements for the Woollever Wrench Company, a new concern, to locate a factory there.

The Bridge Street Garage, Rutherford, N. J., has been incorporated with $100,000 capital by S. D. Ely, M. E. Fake, J. S. Dressler.

Bishop & Babcock, of Cleveland, Ohio, manufacturing soda fountains, brass pumps, faucets, etc., will establish a branch plant in Dallas, Tex.

The board of education, Cleveland, Ohio, is preparing plans for a new training school for which metal and woodworking machinery will be required.

A. Mendelsohn's Sons, Albany, N. Y., whose potash plant recently burned, will put up a new building and install the latest can-making machinery.

The New York, Ontario & Western Railroad is said to be planning the erection of new machine shops at Middletown, N. Y., to build its own locomotives.

The Interstate Car Company, Indianapolis, Ind., will at once build a new foundry. Other additions will also be made at its plant in Brightwood.

The National Supply Company, Toledo, Ohio, manufacturing oil well and plumbers' supplies, has completed plans for extensive additions to its plant.

Kahlenberg Brother, Two Rivers, Wis., have enlarged their plant and will build light gasolene marine motors, more extensively than in the past.

The Ohio Seamless Tube Company, of Shelby, Ohio, has increased its capital stock from $350,000 to $1,000,000 in order to make extensive additions to the plant.

The Four Wheel Drive Auto Company, Clintonville, Wis., has awarded contracts for the erection of a new plant for which machine-tool equipment will be required.

The Navy Department, Bureau of Supplies and Accounts, Washington, D. C., will open bids March 21, for two motor-driven lathes for the Norfolk navy yard as per Echedule 3367.

The Elmore Manufacturing Company, of Clyde, Ohio, manufacturers of the Elmore automobiles, will soon complete a large addition to its plant. The floor space will be trebled.

The Lowrie Manufacturing Company, Springfield, Ill., has filed articles of incorporation and will locate factory. Machinery and tire setters will be manufactured. H. M. Lowrie, manager.

The Universal Nut and Bolt Lock Company, Cincinnati, Ohio, has been organized with $60,000 capital to manufacture nuts and bolts, by F. B. Alter, E. E. Walters, Charles A. Ferrell, etc.

The Aluminum Pump Valve Company, Cleveland, Ohio, has been organized with a capital of $20,000, to manufacture and sell valves for pumps, by Charles W. Colson, Don T. Atkins, Montague J. Haucox, etc.

The Studebaker Corporation, which was organized to combine the E-M-F plant, at Detroit, and the Studebaker plant, at South Bend, will erect at Detroit, it is said, the largest automobile plant in the world.

The Ideal Stamping and Manufacturing Company, Cleveland, Ohio, has been organized with $10,000 capital to operate a general machine shop and do stamping. Incorporators, Albert Mendleson, W. F. Black, S. M. Potter, etc.

The Great Lakes Welding Company, Cleveland, Ohio, has been formed to do welding and metal cutting and manufacture machinery. Incorporators, Henry R. Swartley, Jr., Geo. R. Hall, Augustine Dover, Jr., etc. Capital, $40,000.

The Darke County Automobile Company, Ansonia, Ohio, has been incorporated to operate a garage and sales agency. Incorporators, E. M. Pierce, Harry Strait, W. E. Wicks, Grover Kerns, W. J. Irwin, etc. Capital, $20,000.

The Iron and Manufacturing Company, of Toledo, Ohio, with its plant at Wauseon, Ohio, has increased its capital stock from $50,000 to $100,000, in order to provide more working capital and make extensions in the near future.

The Arcanum Manufacturing and Supply Company, Arcanum, Ohio, has been incorporated to manufacture cement machinery and products, with $10,000 preliminary capital. Incorporators, C. O. Hoffman, C. M. Smith, J. Zipperlin, etc.

The Bowling Green Motor Car Company, Bowling Green, Ohio, has been organized to manufacture and sell motor cars of all kinds. Capital, $100,000. Incorporators, Stanley F. Sawyer, John B. Wilson, Fred C. Moore, F. Lee Roush, etc.

The new foundry, built for the Filer & Stowel Company, Milwaukee, Wis., and located south of the city limits, has been remodeled and will be used by the Beaver Manufacturing Company, builder of gasolene engines and the Petrol Motor Company, who use the Beaver engine in the Petrol automobile.

SOUTHERN STATES

A new roundhouse is to be built at Orangeville, Md., for the Pennsylvania Railroad.

The Severance Manufacturing Company, Nashville, Tenn., has been incorporated with $100,000 capital to manufacture gas machines, tanks, burners, etc. Incorporators, V. C. Severance, A. F. Whitman, W. M. Joseph, etc.

WEST OF THE MISSISSIPPI

F. F. Conner, of Frandreau, S. D., will erect a machine shop.

The Waterloo (Iowa) Gasolene Engine Company will spend $50,000 in improvements.

The Watertown (S. D.) Plow Company will erect a one-story addition to its plant.

The Betts Spring Company, San Francisco, Cal., has taken out a permit to erect a new factory.

The Waterloo Malleable Iron Works, of Waterloo, Iowa, will spend $50,000 in improvements.

The Bakersfield Iron Works, Bakersfield, Cal., will build an addition to its plant and install new machinery.

Fountain & Wing, Banning, Cal., will build a commercial garage. Modern repair machinery will be installed.

J. M. Pettinger, Portland, Ore., will build a commercial garage. Modern repair machinery will be installed.

The Leonard Construction Company, Chicago, Ill., is planning to install a fabricating plant at Irondale, Wash.

The Dille & McGuire Manufacturing Company, Richmond, Ind., manufacturing lawn mowers, will build an addition.

Andrew R. Porter, Portland, Ore., will build a commercial garage and repair station. Modern equipment will be installed.

G. E. Starkweather, Box 180, Tampico, Mexico, is interested in the purchase of a lathe, drill press, shaper, planer, grinder.

M. Schussler and Jas. C. Nolan, San Francisco, Cal., will build a commercial garage and repair shop. Modern equipment will be installed.

The Kline Invalid Bed Company, Los Angeles, Cal., N. W. Kline, president, now building a factory at Wilmington (Los Angeles), has been changed to the Kline Invalid Bed and Machine Company, and will operate a general machine shop and foundry in connection with its specialty.

CANADA

The Harding Motor Car Company, of London, will extend its plant.

The Winkley Fire Arms Company is building a new factory at Windsor, Ont.

The British Columbia Steel Company will erect an immense plant at Port Mann, B. C.

G. M. Ellis has secured 30 acres at St. Boniface, Man., on which a million-dollar auto factory will be built.

General Manufacturing

NEW ENGLAND

D. J. Burke, Rockland, Mass., will install a boiler and engine.

H. P. Wood & Sons, Boston, Mass., will install a boiler and engine.

Schwartz Brothers, Bridgeport, Conn., will erect a new woodworking plant.

The emery plant of the Pike (N. H.) Manufacturing Company was burned.

The State of Massachusetts will install an engine at the Rutland sanatorium.

The John Shepard Company, Providence, R. I., will install a new power plant.

The J. D. Clark Company, Rochdale, Mass., will rebuild its dyehouse recently burned.

The Hunt-Rankin Company, South Peabody, Mass., will purchase a power pump.

The Conners Brothers Company, Lowell, Mass., is in the market for concrete mixers.

The Morris Auto Company, South Easton, Mass., will install steam and electric equipment.

The Massachusetts Land Brick Company will install an engine at the West Oxford plant.

The hosiery mills of H. H. Wood & Co., Laconia, N. H., were destroyed by fire. Loss, $25,000.

The Boston Wagon Company, Boston, Mass., is in the market for woodworking machinery.

The Standard Fabric Company, Fall River, Mass., will erect a three-story factory building.

Tappan Brothers, Attleboro, Mass., are figuring on a larger engine, present one being too small.

Fire destroyed a large amount of machinery at the box factory of J. L. Brackett & Sons, Portland, Me.

The National Spring Bed Company, New Britain, Conn., will erect a five-story addition and a boiler house.

The Windham Handle Company, formerly of South Windham, Conn., has removed its plant to Willimantic, Conn.

The Willimantic (Conn.) Industrial Company will soon place a contract for a mill building and a boiler house.

The Wetherbee Brothers, Arlington, Mass., are in the market for a 60-light, 110-volt generator and storage battery.

The Mansfield (Mass.) Bleaching Company intend adding about 300 horsepower to its steam equipment this spring.

The Penfield Shock Absorber Company, Meriden, Conn., will establish a factory for the manufacture of shock absorbers.

The Common-Sense Chewing Gum Company, of Boston, Mass., is to open a factory at Newport, R. I. E. C. Tarr, of Boston, Mass., is president.

Wheaton Seminary, Norton, Mass., will install additional boiler, also steam engine and electric-light equipment for new buildings and fire pump.

Elmer A. Loring, Brockton, Mass., has purchased a large shoe-manufacturing plant in that city, and will occupy same after making extensive improvements.

Fire destroyed the electric coal hoist at the pocket of the Metropolitan Coal Company,

Liverpool wharf, Atlantic avenue and Congress street, Boston, Mass. Loss, over $5000.

Item in the February 23 issue to the effect that the plant of Andrew J. Morse & Son, Inc., Boston, Mass., was badly damaged, is misleading, as the damage was very slight, being confined to outside of building.

The Universal Optical Company has been incorporated at Providence, R. I., to manufacture optical goods. Capital, $50,000. Incorporators are Joseph Rosenblatt, E. Beatty and H. J. Humphrey, all of Providence.

The Dennison Manufacturing Company, of South Framingham, Mass., is contemplating the installation of two new 75-horsepower boilers in the building, owned by it, at Roxbury, Mass., and known as the Roxbury tag factory.

MIDDLE STATES

Fire destroyed the pump house of Otto Arens, Plainfield, N. J.

The plant of the Bangor Brewing Company, Bangor, Wis., was burned.

The Elkhart (Ind.) Bristol Board and Paper Company will increase its output.

The High Grade Oil Company will erect a $75,000 refinery at Queens Junction, Penn.

The E. F. Giberson Company, cut-stone contractors, Bedford, Ind., will build a new mill.

The Hussa Brewing Company, of Bangor, Wis., is planning the erection of a larger plant.

J. H. Staddler, Cleveland, Ohio, fertilizing plant, will make additions to its factory and machinery.

The Kreiter Piano Company, Milwaukee, Wis., will build a large factory at North Milwaukee.

The E. G. Schlichter Company is preparing to build a silo and tank factory in Morristown, Penn.

The Hudson Hat Company, Newark, N. J., will erect an addition to its factory, also new power plant.

The Engel-Kress pocketbook factory, at West Bend, Wis., was destroyed by fire. Loss, $200,000.

The National Knitting Company, of Milwaukee, will establish a branch factory at Stoughton, Wis.

Williams Shoe Company, Cincinnati, Ohio, has increased its capital to $1,600,000. Will enlarge its plant.

The Hunt-Kerber Stone Company, Bedford, Ind., will build a large mill near its quarry, near Oolitic, Ind.

The H. Leet Lumber Company, of Portsmouth, Ohio, plans the erection of large additions to its plant.

The Pennsylvania Railway, Cleveland, Ohio, is having plans prepared for a new boiler house and equipment.

The Friends Almshouse, at 316 Walnut street, Philadelphia, Penn., will install an engine and dynamo.

Brown & Kearney, of Warsaw, N. Y., manufacturing wood novelties, will move its plant to Silver Springs, N. Y.

Ohio Seamless Tube Company, Shelby, Ohio, increased its capital to $1,000,000. New equipment will be installed.

The John Scott & Co., Detroit, Mich., a new concern, will erect a large ice plant at Hastings and Trombly avenues.

The city of Philadelphia, Penn., is receiving estimates for new boilers and repairing old boilers at the General hospital.

Edwards Shoe Company, Findlay, Ohio, increased its capital from $10,000 to $100,000. Will place some new equipment.

The Vulcan Iron Works, Wilkes-Barre, Penn., has had plans prepared for a new building to be used as a pattern shop.

Fire damaged the power plant of the Northern Westchester Lighting Company, at Ossining, N. Y., to the extent of $8000.

Garrett & Son, wagon builders, Philadelphia, Penn., will erect a new factory at Thirty-ninth and Spring Garden streets.

S. S. Miller, hosiery manufacturer, Reading, Penn., has taken out a permit for a three-story factory at 118-120 North Third street.

S. C. Kelly, of Sandusky, Ohio, and associates, will incorporate the Kelly Plaster Company, and will erect a plant at Castalia, Ohio, five miles from Sandusky.

The Snook-Veith Lumber Company, a new concern, capitalized at $100,000, now being incorporated under the laws of Ohio, has decided to locate at Ivorydale, Ohio.

The Sarfert Knitting Mills has been incorporated at Philadelphia, Penn., by Max Sarfert, Peter Hernig and Harry Sarfert, to manufacture knit and woven fabrics.

The Elkhart (Ind.) Paper Company will spend over $300,000 on improvements at its mill, including large machine room and finishing building, steam-roller plant, etc.

The Tarco Construction Company control 80 acres of gravel land, at Valley Junction, Ohio, and propose installing a washer, screening and crusher plant at a cost of $10,000.

The Law-Carpenter Company, Toledo, Ohio, will shortly begin the erection of a new plant, which will nearly double the present factory. The concern manufactures molding.

The Citizens Light and Fuel Company, of Washington, Ind., has been incorporated with a capital of $75,000, by P. M. Taylor, Thomas Burus and L. P. Boyle, to operate a light and fuel plant.

D. B. Dunham & Sons have let contract for the construction of a five-story factory at Central avenue and Fourth street, Newark, N. J., to be used for the manufacture of automobile bodies.

The Navy Department, Bureau of Supplies and Accounts, Washington, D. C., will open bids March 21, for one mortising machine (Schedule 3366), and on April 4 for electric crane (Schedule 3368).

The Snyder Manufacturing Company, Wapakenota, Ohio, announces that its plant at that place, which was recently destroyed by fire, will be rebuilt. The company manufactures furniture and lumber.

The Massasoit Wadding Company, Waterford, N. Y., has been incorporated to manufacture knit goods. Capital, $50,000. Incorporators, S. L. & E. G. Munson, of Albany; Wm. B. Cook, of Waterford.

The Navy Department, Bureau of Supplies and Accounts, Washington, D. C., will open bids March 14, for four blowers (schedule 3373), 24 brass globe valves (schedule 3377), three voltmeters (schedule 3376).

The Western Manufacturing Company, Toledo, Ohio, has purchased a piece of property adjoining its plant on which it will erect an addition and increase its output. The concern manufactures sash, doors, etc.

The Limestone Products Company, of Columbus, Ohio, has been organized with a capital of $100,000 to operate a stone-crushing plant. The incorporators are J. M. Stone, B. F. Waples, A. L. Ralston, H. C. Sherman, etc.

The Navy Department, Bureau of Supplies and Accounts, Washington, D. C., will open bids March 14, for 5000 pounds round brass, 175,000 pounds manganese brass in ingots, 14,500 pounds naval bronze, 308,480 pounds steel castings (schedule 3371), 72,500 pounds steel angles, 69,500 pounds steel plates and shapes (schedule 3375), 2100 pounds machinery steel, 63,600 pounds medium bar steel (schedule 3374), 40,000 pounds medium plate steel (schedule 3374).

SOUTHERN STATES

Fire destroyed tobacco factories of F. D. Williams & Co., and Larus Brothers & Co., Richmond, Va.

The Southern Power Company is erecting a 10,000-horsepower plant, at Greensboro, N. C., to be used as an auxiliary plant.

WEST OF THE MISSISSIPPI

Cole Castings, of White, S. D., will erect a feed mill.

The city of Salem, Ore., will install a new lighting system.

The city of Hillyard, Wash., will install a new sewer system.

Theo. Karlson is erecting a blacksmith shop at Shields, N. D.

The city of Las Vegas, Nev., is planning to install a new sewer system.

The city of Madras, Ore., is planning to install a new water system.

The city of Missoula, Mont., is planning to install a new sewer system.

M. Rheinstein, Portland, Ore., will build a new brewery in this vicinity.

W. H. Slaughter, Glendale, Ariz., will establish a large ice-making plant.

Q. E. Gwynne, Lostine, Ore., will build a new sawmill in this section.

The Union Creamery Association, of Bixby, Minn., will erect a new creamery.

The Potlatch Lumber Company, Elk River, Idaho, is building a new planing mill.

The State Center (Iowa) Creamery Association will build a modern creamery.

The city of Elma, Wash., is planning extensive improvements in its water system.

Ritari Brothers, of Brainerd, Minn., will build a factory to manufacture cement blocks.

John Olness is secretary of a creamery, at Peterson, Minn., which will erect a creamery.

The Lompoc Seed Growers' Association, Lompoc, Cal., is planning to erect a new plant.

The American Oilfields Company, near Fellows, Cal., is planning to erect a refining plant.

J. Biandino, Portland, Ore., is planning to erect a factory for the manufacture of macaroni.

The city of Pocatello, Idaho, is planning for extensive improvements in its sewer system.

The Pacific Fruit Package Company, Raymond, Wash., will build an addition to its factory.

McCullough & Sons, of Webster City, Iowa, will erect an addition to their feed-trough factory.

Mitchem Brothers, Spokane, Wash., will build a new packing plant to cost about $50,000.

A franchise has been granted Ernest Marshall, of Oakes, N. D., to install an electric-light plant.

The William Taaffe Tanning Company, San Francisco, Cal., will build an addition to its factory.

The Winchester Lumber Company, Winchester, Idaho, will install new equipment in its sawmill.

The Weinhart Brewery, Portland, Ore., will soon commence the erection of a new bottling works plant.

The Norfolk Chemical and Oil Company will build a factory on North Seventh street, Norfolk, Neb.

The plant of the White River Lumber Company, Eltopia, Wash., was destroyed by fire. Loss, $10,000.

The city of Petaluma, Cal., is planning to build a gas plant. Operations will begin in the near future.

The White Pine Lumber Company, Baker City, Ore., is planning to erect a box factory and planing mill.

The city of Marcus, Wash., is planning to install a new water-supply system and build a lighting plant.

The city of Ellensburg, Wash., will increase the capacity of its power plant from 600 to 2000 horsepower.

The Tempe Creamery Company, Tempe, Ariz., is having plans prepared for a new cold-storage plant.

The city of White Bluffs, Wash., is planning to install an entire electric system for lighting and power.

The I Creamery, Independence, Ore., is planning to erect a new factory for the manufacture of ice cream.

The Oregon Power Company, Springfield, Ore., is planning to install a new tungsten street-lighting system.

Dr. W. M. Hunt, of Draper, S. D., is planning the installation of an electric-light system for the town.

The Hewett-Lea Lumber Company, Seattle, Wash., is planning to make improvements in its plant at Kirkland.

H. C. Keeran, North Bend, Wash., is planning to establish a factory for the manufacture of broom handles.

J. H. Hart, of Danbury, Iowa, will install an ammonia refrigerator plant in connection with his meat market.

The city of Newport, Cal., is planning the erection of a municipal lighting plant. About $50,000 will be expended.

The Gilt Edge Shingle Company, Bellingham, Wash., is planning to rebuild its plant recently destroyed by fire.

The American Laundry Company, Spokane, Wash., is planning to make improvements in its boiler-plant equipment.

J. Schlotter, La Mesa Springs, Cal., is contemplating the erection of an ice plant. About $14,000 will be expended.

The Car Line Land Company, Missoula, Mont., will install an irrigation system on its property in this section.

The Eldorado Orchard Tracts, Pasco, Wash., will install new electric pumping equipment in the near future.

The Star Bucket and Pail Company, St. Louis, Mo., will erect a three-story factory at 1220 North Fifteenth street.

H. Zoolof, Los Angeles, Cal., has taken out a permit to erect a pump house and will install new pumping equipment.

The Petaluma & Santa Rosa Electric Railroad Company, Petaluma, Cal., has been granted a franchise by the city.

The Pacific Burial Case Company, Los Angeles, Cal., has taken out a permit to erect a boiler-room addition to its plant.

The stockholders of the Gilt Edge Creamery Association are considering the erection of a creamery at Owatonna, Minn.

The city of Lodi, Cal., is planning to install a new street-lighting system.

B. L. Gray, of St. Joseph, Mo., will establish a cement plant on the Slayton farm, in Georgetown, near Iowa Falls, Iowa.

S. M. Ellis and J. A. Snyder, of Watertown, S. D., are planning the installation of an electric-light plant at Hayti, S. D.

The Redondo Planing Mill Company, Redondo, Cal., is doubling the capacity of its plant. About $20,000 will be expended.

White Brothers, Lewiston, Ida., are planning to install an irrigation system on property in this section to cost about $10,000.

The Peoples' Water Company, Oakland, Cal., will build a new pumping plant to cost $10,000, exclusive of pumping equipment.

The Spreckels Company, San Francisco, Cal., is planning to purchase property near Martinez, and establish a rock-crushing plant.

The Olmstead Lumber Company, Anaheim, Cal., is building an addition to its plant, and will install new planing-mill equipment.

The substation of the Idaho Consolidated Power Company, Pocatello, Idaho, recently destroyed, will be rebuilt and new machinery installed.

The city of South Pasadena, Cal., is contemplating the installation of a sewerage disposal system to serve three communities in this section.

The Diamond Mills Company, Revelstoke, B. C., is planning to build a new lumber mill at Arrowhead. C. A. Barnum is manager of this company.

New boiler equipment will be installed in the hotel of Smith & Dooley, Portland, Ore. The company is located in the Board of Trade building.

The Lima Bean Growers' Association, Ventura, Cal., will build a new canning plant to cost about $30,000. Mr. Waterman, manager of association.

The Pine Creek Irrigation Company, Weston, Ore., is planning for extensive irrigation work in this vicinity; about $400,000 will be expended.

Power-plant equipment will be required in the new hotel contemplated by Henry J. Sollers, at Bakersfield, Cal. About $65,000 will be expended.

The O. W. Kerr Company, Minneapolis, Minn., is planning to install an irrigation system in the vicinity of Missoula, Mont., to cost about $75,000.

Richard Hastings, Visalia, Cal., has been granted a telephone and water franchise for the Lost Hills district. Operations will begin in a short time.

W. B. Allen and Henry Stroven, Holtville, Cal., are at the head of a company which will establish a large creamery and cold-storage plant in this vicinity.

The Redondo Beach Ice and Cold Storage Company has been incorporated at Los Angeles, Cal., by C. R. Johnson and H. J. Mead, with a capital stock of $20,000.

The resawing department of the Anacortes Lumber and Box Company, Anacortes, Wash., was destroyed by fire. Loss, $20,000. A new resaw plant will be built at once.

Swanbey & Schneider, heating contractors, Portland, Ore., will move into larger quarters and install a complete assortment of machinery in keeping with their business.

The Carbolineum Treating and Paving Company, Spokane, Wash., will build a new plant to cost about $25,000. C. P. Lindsley, Spokane, is head of this company.

The Winnette Irrigation Company has been incorporated at Lewiston, Ida., for $100,000. The company is planning for extensive irrigation work in the Flatwillow section.

Byron D. Beckwith, Colusa, Cal., is planning to irrigate 40,000 acres in this vicinity and build a power plant. Water appropriations have been filed in three sections.

Power-plant equipment will be required in the new 11-story office building to be erected by the Union Oil Company, at Los Angeles, Cal. About $1,000,000 will be expended.

Power-plant equipment will be required in the Terminal hotel to be erected at San Francisco, Cal. About $200,000 will be expended. William Curlett & Son, architects, San Francisco, Cal.

The Coalinga Domestic Water Company has been incorporated at Coalinga, Cal., by F. Cheney and C. N. Sanderson, with a capital of $10,000. The company is planning extensive operations.

The Yakima Meat Company, North Yakima, Wash., has been purchased by Chas. Bruhn and O. D. Gibson, Seattle, Wash. The company is planning to establish a packing factory. Modern equipment will be installed.

The Washington-Oregon Corporation, Kelso, Wash., has assumed control of the Kelso Electric Company and is planning to make improvements in its power-plant equipment. A power plant will be built on the Kalama river.

Power-plant equipment will be required in the new Multnomah hotel to be erected at Portland, Ore. About $450,000 will be expended. The Leonard Construction Company, Chicago, Ill., has the general contract for the work.

CANADA

Robert Dodds, of Guelph, will locate a big carpet factory at Perth, Ont.

The Cobalt Power Company, of Cobalt, Ont., will make extensions to its plant.

The Manitoba Rolling Mills Company, of St. Boniface, Man., will double its plant.

Prince Albert, Sask., will install electrical machinery to develop 10,000 horsepower.

The North American Smelting Company will erect a lead smelter at Kingston, Ont.

Edmonton, B. C., is in the market for a large quantity of brass waterworks supplies.

The North American Smelting Company will build an immense plant at Kingston, Ont.

The Spanish River Pulp Company will equip a million-dollar plant at Spanish River, Ont.

The British Columbia Telephone Company will equip a large substation at Vancouver, B. C.

Saskatoon, Sask., will spend $140,000 for machinery for a municipal lighting and power plant.

The Vancouver Gas Company, of Vancouver, will make important extensions to its plant.

The Dominion Power and Traction Company will equip a new power station at Brantford, Ont.

The Dominion Axminster Company will build a large carpet-weaving factory in Toronto.

The Hobbs Hardware Company will extent its big plate glass and mirror works, at London, Ont.

The Canadian General Electric Company, of Peterboro, will build a $250,000 addition to its factory.

The Dominion Power and Traction Company, of Hamilton, will install new generators and turbines.

Souris, Man., will spend $95,000 for new waterworks machinery, including gasolene engines, pumps and compressors.

J. S. Ainslee & Brother, Comber, Ont., are rebuilding their saw and cooperage mill, which was destroyed by fire a short time ago.

Twenty thousand dollars worth of machinery destroyed in the big Braula carriage factory, at Montreal, will be replaced immediately.

Ten thousand dollars worth of machinery destroyed by fire in the big mill No. 1, of the Canadian Western Lumber Company, at Port Mann, B. C., will be replaced at once.

MINING

The Brazilian Gold Hill, Ltd., operating at Lavras, Brazil, will install a stamp mill.

The Shoshone Mining Company, near Austin, Nev., is planning for the erection of new furnaces.

The Idaho Democrat mine, Blaine county, Idaho, is planning to build a hydroelectric power plant.

The Lucia Mining Company, operating at Avino, Durango, Mexico, will install a 50-ton cyanide plant.

The Seattle-Alaska Copper Company, La Touche island, Alaska, will install new stamp-mill equipment.

The Yaqui Mines Company, operating on the Veta Grande property, Sonora, Mexico, will install an aërial tramway.

The San Rafael mines, Guanacevi, Durango, Mexico, are contemplating the installation of a concentration plant.

The Santo Nino mine, Chihuahua, Mexico, is contemplating the installation of a 100-ton reduction plant in the near future.

The American Smelting and Refining Company is said to be contemplating the erection of a smelting plant at Nuevo Laredo, Nev.

Monte Cristo mine, operating in the Yellow Pine district, near Good Springs, Nev., is planning the installation of an aërial tramway.

The Calumet & Arizona Mining Company, operating near Bisbee, Ariz., will enlarge its smelting plant. About $500,000 will be expended.

The Black Eagle Company, operating the National mine, Rawhide, Nev., will install new cyanide equipment, power apparatus and compressors.

The Sylvania Mining Company, operating near Lida, Nev., will build a 100-stamp mill and concentration plant. About $50,000 will be expended.

The Mojave Mines, Inc., operating the Mojave mine, near Silver Mountain, San Bernardino, Cal., has decided to install a gas-producer plant.

The Balaklala Copper Company, operating in the Balaklala district, Shasta county, California, is planning to install new furnaces in the near future.

The Kate Hardy mine, near Forest, Sierra county, Cal., will build a 40-stamp mill in 1911. Kate Hardy Consolidated Mining Company, Los Angeles, Cal.

The Scott Bar Hydraulic Mining Company, operating near Redding, Cal., has acquired property, near Yreka, and is contemplating the installation of a dredge in the near future.

The Mineral Creek Power Company, Valdez, Alaska, is planning to install a new power plant for mines operation; a custom milling plant will also be erected. An aërial tramway is being contemplated.

BUSINESS ITEMS

The firm of Albert B. Bowman, dealer in machine-shop equipment, St. Louis, Mo., has been superseded by the Bowman-Blackman Machine Tool Company, due to the entrance into the firm of G. H. Blackman.

The J. S. Bretz Company, 250 West Fifty-fourth street, New York, has been appointed sole selling agent for the Hartford (Conn.) Auto Parts Company.

The Grand Rapids Machine Tool Company has been incorporated for $20,000 with $10,000 subscribed and paid in. The officers are Matthew Lund, president; D. F. Nellist, vice-president; G. C. Mason, secretary and treasurer. Milling machines will be manufactured. All equipment has been bought.

TRADE CATALOGS

La Salle Machine and Tool Company, La Salle, Ill. Folder. Plain and surface grinder. Illustrated.

The Standard Machinery Company, Mystic, Conn. Pamphlet. Colt's Twentieth Century ball-bearing drill chuck. Illustrated.

Wilmarth & Morman Company, Grand Rapids, Mich. Catalog No. 95. Grinding machinery. Illustrated, 48 pages, 6x9 inches, paper.

Lucas Machine Tool Company, Cleveland, Ohio. Circular. No. 32 "Precision" horizontal boring, drilling and milling machine. Illustrated.

The Cleveland Pump and Shear Works Company, Cleveland, Ohio. Hand Book and Stock List No. 4. Illustrated, 62 pages, 4½x7 inches.

The Hawley Down Draft Furnace Company, 736-738 West Monroe street, Chicago, Ill. Bulletin No. 23. Something About Crucibles. Illustrated.

CATALOGS WANTED

The American Designing Company, Highland building, Pittsburg, Penn., engineers, designers and draftsmen, would like catalogs for its purchasing department.

The Metal Products Company, Detroit, Mich., would be pleased to receive catalogs of office furniture, office appliances, small tools, shop tools and general shop equipment.

FORTHCOMING MEETINGS

American Supply and Machinery Manufacturers' Association, National Supply and Machinery Dealers' Association and Southern Supply and Machinery Dealers' Association; joint annual convention, Hotel Seelbach, Louisville, Ky., April 3-5, 1911. F. D. Mitchell, secretary, 309 Broadway, New York City.

National Metal Trades Association, thirteenth annual convention, April 12-13, Hotel Astor, New York City. Robert Wuest, commissioner, New England building, Cleveland, Ohio.

American Foundrymen's Association, annual convention, Pittsburg, Penn., May 23 to 26, 1911. Richard Moldenke, secretary, Watchung, N. J.

American Society of Mechanical Engineers, spring meeting, Pittsburg, Penn., May 30 to June 2, 1911. Secretary, C. W. Rice, 29 West 39th St., New York City.

The Institute of Operating Engineers. Regular meeting second Thursday of each month, Engineering Societies building, New York City. M. W. Rice, secretary, 29 West Thirty-ninth street, New York City.

American Society of Mechanical Engineers; monthly meeting second Tuesday. Calvin W. Rice, secretary, 29 West Thirty-ninth street, New York City.

Boston Branch National Metal Trades Association. Monthly meeting on first Wednesday of each month, Young's hotel. D. F. S. Clark, secretary, 141 Milk street, Boston, Mass.

Providence Association of Mechanical Engineers. Monthly meeting fourth Tuesday each month. E. C. Bliss, president, 91 Sabine street, Providence, R. I.

New England Foundrymen's Association; regular meeting second Wednesday of each month, Exchange Club, Boston, Mass. Fred F. Stockwell, 205 Broadway, Cambridgeport, Mass.

Engineers' Society of Western Pennsylvania; monthly meeting third Tuesday. Elmer K. Hiles, secretary, Fulton building, Pittsburg, Penn.

Superintendents' and Foremen's Club of Cleveland; monthly meeting third Saturday. Philip Frankel, secretary, 310 New England building, Cleveland, O.

Western Society of Engineers, Chicago, Ill. Regular meeting first Wednesday evening of each month, excepting July and August. Secretary, J. H. Warder, 1735 Monadnock block, Chicago, Ill.

Philadelphia Foundrymen's Association; meetings first Wednesday of each month, Manufacturers Club, Philadelphia, Penn. Howard Evans, secretary, Pier 45 North, Philadelphia, Penn.

WANTS

Rate 25 cents per line for each insertion. About six words make a line. No advertisements abbreviated. Copy should be sent to reach us not later than Friday for ensuing week's issue. Answers addressed to our care, 505 Pearl Street, New York, will be forwarded. Applicants may specify names to which their replies are not to be forwarded, but replies will not be returned. If not forwarded, they will be destroyed without notice. No information given by us regarding any advertiser using box number. Original letters of recommendations or other papers of value should not be inclosed to unknown correspondents. Only bona-fide advertisements inserted under this heading. No advertising accepted from any agency, association or individual charging a fee for "registration," or a commission on wages of successful applicants for situations.

MISCELLANEOUS WANTS

Caliper catalog free. E.G.Smith, Columbia, Pa.

We buy or pay royalty for good patented machine or tool. Box 282, AMER. MACHINIST.

Wanted—Work for screw machines and gear cutter. Box 775, AMERICAN MACHINIST.

Mechanical drawing, light, accurate machine work. J. B. Poore, Washington, N. J.

Light, fine machinery to order; models and electrical work specialty. E. O. Chase, Newark, N. J.

Light and medium weight machinery and duplicate parts built to order; tools, jigs, etc. MacCordy Mfg. Co., Amsterdam, N. Y.

The Brunswick Refrigerating Co., of New Brunswick, N. J., are prepared to take on one or more manufacturing propositions.

Wanted—Light and medium weight special machinery, jigs and fixtures, punches and dies, etc., to build to order. Box 520, AM. M.

Patents. C. L. Parker, Patent Attorney, ex-examiner Patent Office, 900 G St., Washington, D. C. Write for Inventor's Handbook.

Wanted—To manufacture on contract, small machines or parts, tools, hardware, or other metal articles. G. W. Parker, Keene, N. H.

Wanted—Work for gear cutters, hand turrets, milling machines, etc.; fine work in quantities. The Seneca Falls Mfg. Co., Seneca Falls, N. Y.

Wanted—Machine shop to manufacture and market new labor saving machine without any competition; royalty or cash. Box 579, AMERICAN MACHINIST.

Agency for machinery and tools, covering Pittsburg district, is wanted by well known and established engineer. "Engineer," Box 491, AMERICAN MACHINIST.

Wanted—An article to manufacture suitable for the railway, automobile or hardware trade; must be patented and exclusive. Address Box 356, AMERICAN MACHINIST.

Light and medium weight machinery and small parts in quantities; also screw machine and punch press work, tools, jigs, dies and high grade machinery. The Elgin Tool Works, Elgin, Ill.

Tools, dies, jigs and light and medium weight machinery designed and built to order; duplicate parts, either machined or die cast. Precision Die Casting Co., 422 So. West St., Syracuse, N. Y.

Large English firm of machine tool importers having showrooms and offices in Great Britain, France, Germany, Italy, India and Japan is wanting good agencies for machine tools of all kinds. Box 189, AMER. MACH.

Cummings Machine Company, 238 William street, New York. Estimates given on automatic machinery, bone hardening, grinding and jobbing; uptodate plant; highest grade work done with accuracy and despatch. 'Phone 5592 Beekman.

Wanted—One second-hand universal grinder, medium size; one second-hand shaper about 16 inches; one second-hand universal miller, complete for cutting spirals, small to medium size. Highland Park College, O. H. Longwell, president, Des Moines, Iowa.

Welding by oxyacetylene process; special attention given to repairs of machinery and castings of all kinds; large experience in difficult experimental work; structural shapes welded together. Write for particulars. Krajewski-Pesant Company, 54 Beard St., Brooklyn, N. Y.

We operate a well equipped machine shop for all kinds of accurate work; we assist in developing ideas or designing machinery to accomplish certain results, overcoming imperfections in construction or design; we invite correspondence; estimates furnished; prices reasonable. E. V. Balliard Company, 18 Frankfort St., New York City.

European Business — Competent business man, well posted and acquainted in machinery business, also acquainted throughout Europe, wishes to represent or attend to foreign business for a few manufacturers; expect to make a trip soon and visit all important cities of Europe; highest references. Address "W.," AMERICAN MACHINIST.

HELP WANTED

Classification indicates present address of advertiser, nothing else.

CONNECTICUT

Wanted—Working foreman for a blacksmith shop of four or five fires, one understanding annealing and case hardening; good wages and steady work to the right man; shop in Connecticut. "A. B. C.," AM. MACH.

Instructor wanted to teach the machinists' trade and toolmaking in a large well established trade school; must have had successful experience in directing the work of others, either as foreman or in teaching this line of work; salary, $800 to $1000 for first year; give full details of your experience and be prepared to furnish, when called for, good references as to moral character, personality, ability as a foreman and skill as a mechanic. Box 574, AMERICAN MACHINIST.

ILLINOIS

Draftsmen—For tool drafting work; we need men who have had experience as designers on punch and die or jig and fixture work; in answer, state fully your experience along this line of work, salary desired and how soon you could report. Address Department 1056, Western Electric Co., Chicago.

MASSACHUSETTS

Wanted—Superintendent; must be able to make accurate advance estimates on screw machine and press production of special turned and stamped metal parts; ability to originate economical ways of producing such parts essential; experience in rolled thread and upset work, simple assembling and plating desirable; if you are the right man this opportunity is exceptional. Box 581, AM. M.

MICHIGAN

Wanted—Mechanical engineer, thoroughly familiar with practical shop operations, to get highest efficiency for machine tools; must be a gear expert in all its details; state age, whether married or single, salary required and give references. Box 569, AMER. MACH.

Wanted—Immediately, superintendent for jobbing and manufacturing machine shop; one who can look after shop and do some work himself; business is getting too large for owner to handle alone; state age, experience, references and salary expected. Jarvis, Lansing, Mich.

NEW JERSEY

Wanted—Throughly competent draftsman on condensers, pumps, etc; location near New York; state age, experience and salary expected. Address Box 570, AMER. MACHINIST.

NEW YORK

Wanted—Experienced drop forge die sinkers at once. Address Superior Axle & Forge Co., 1700 Elmwood Avenue, Buffalo, N. Y.

Wanted—A first class designer for special printing machinery; only those who can furnish the best of references need apply. Box 566, AMERICAN MACHINIST.

Foundry foreman by manufacturing concern employing thirty molders on bench work; must have experience with machines; open shop. Box 572, AMER. MACHINIST.

Norton and Landis grinders hands; first class lathe hands, milling and radial drill; first class vise and all-around men on automobile engines and parts, good toolmaker. Philip H. Gill & Sons, Brooklyn, N. Y.

Wanted—Superintendent for bolt factory manufacturing all kinds of bolts, etc.; southern location; none but first class men who are thoroughly familiar with all branches of the business need apply. Box 571, AM. MA.

Wanted—Live young man, experienced in cost keeping and shop practice, for large plant located in city of 20,000 inhabitants; good position for right man; state age, experience and salary expected. "Manufacturer," AM. M.

Young man, familiar with hot bending alloy steels and capable of taking charge of small shop; must be accustomed to laying out and finishing small tools for hot bending and grinding machines; state age, salary and experience. Box 575, AMERICAN MACHINIST.

Wanted—Superintendent for long established company manufacturing machine tools of high grade; must be competent to take full charge of machine shop and foundry and direct the designing of special fixtures and new tools; state fully, experience, education, age and salary. Box 513, AMER. MACHI. INST.

Shop foreman with executive ability is required by manufacturer of heavy and light machinery; one experienced as lathe builder preferred; must be capable of producing duplicate parts in quantity with accuracy and cheapness; applicant must be able to furnish references; state age, experience and compensation desired. Address "T. M. C.," AM. MA.

Wanted—Expert designer and experimenter to develop new machinery; shop experience and originality absolutely essential; knowledge of glass manufacture, automatic machinery and with technical training desirable; give present connection and past experience fully, and they will be treated as confidential; new firm, new undertaking; excellent opportunity. Address "Glass," AMER. MACHINIST.

OHIO

Wanted—First-class lathe hands; state age and experience. The Heisler Co., St. Marys, O.

Wanted—Man between 25 and 35 years, to act as chief inspector in a machine tool plant; must be capable of formulating and perfecting complete inspection system; capable not only of detecting mistakes, but suggesting and applying the remedy; good salary to right man. Box 536, AMERICAN MACHINIST.

Wanted—First class machinists, toolmakers, die sinkers, lathe, planer, drill press, screw machine, boring and milling machine operators, wood and metal patternmakers, brass polishers, buffers, finishers, millwrights, hammermen and blacksmiths, who wish to increase their opportunities, to register with the free Employment Department of the National Metal Trades Association, New England Building, Cleveland, Ohio.

PENNSYLVANIA

Works superintendent for old established manufacturing company; must be thoroughly familiar with turret machinery, etc., and modern production methods. Box 586, AM. M.

Wanted—A technically educated, economy and efficiency expert, in a high-speed machinery manufactory, employing about four hundred mechanics, near Philadelphia. Box 550, AMERICAN MACHINIST.

Wanted—Mechanical engineer to act as assistant superintendent and designer in machine shops; state experience, age and salary desired; also give references. Address "BMC," AMERICAN MACHINIST.

Draftsmen and detailers wanted; applications solicited from those with small tool, jig and fixture experience on small interchangeable parts; state fully, experience, education, age and salary expected. Box 535, AM. MA.

The Monotype School is maintained to train young men to meet the constant demand for operators of our type casting and composing machine; these operators do so well that we receive more applications for places than can be filled; these qualifications carry most weight: Common sense, automatic machinery experience, printing office experience, type foundry experience. Full particulars will be furnished to inquirers who furnish the same information about themselves, and mention this paper. Lanston Monotype Machine Co., Philadelphia.

UTAH

Wanted—Competent instrument maker, familiar with surveying instruments; must be able to rebuild and adjust transits; married man preferred. Address, giving full particulars, G. P. Keller Mfg. Co., Room 2 Board of Trade Bldg., Salt Lake City, Utah.

SITUATIONS WANTED

Classification indicates present address of advertiser, nothing else.

CONNECTICUT

Experienced tool and die maker wants position as foreman, with buckle or novelty manufacturer; employed, but wishing a change; age 38. Box 546, AMER. MACHINIST.

ILLINOIS

Manager or superintendent, with practical knowledge of modern manufacturing methods, desires a position; experience includes direction of offices and works, maintenance of plant, motive power, electrical apparatus, etc. Box 565, AMERICAN MACHINIST.

MICHIGAN

Foreman, expert knowledge of steel treating, uptodate methods for carbonizing, hardening, tempering and machine blacksmithing; high speed steel a specialty. Box 556, AM. M.

NEW JERSEY

Thoroughly practical uptodate mechanic wishes position with a responsible concern as salesman and demonstrator of tool steel. Address H. J. Stewbell, 186 So. 11th St., Newark, N. J.

NEW YORK

Mechanical engineer, graduate, ten years' designing and shop experience, best references, desires change. Box 559, AM. MACH.

Designer, experienced on automatic and special machinery, capable of taking charge of work. Box 584, AMERICAN MACHINIST.

Hardener and case hardener of long experience, with all kinds of steel, uptodate methods on automobile parts. Box 576, AM. M.

Superintendent, expert mechanic, designing and developing equipment and general supervision of manufacturing. Box 582, AM. MA.

Machine designer and mechanic with 14 years' experience, desires change; capable of designing and getting out special machinery or motor cars from ideas furnished; New York City preferred. Box 547, AMER. MACHINIST.

Production man, all-around mechanic, understand thoroughly use of planers, lathes, milling machines, gear cutters, etc; able to instruct operators and increase results; at present employed; $1500 to $1800. Box 573, AMERICAN MACHINIST.

A broad gage man, with successful shop, foundry and business experience, desires responsible position as superintendent or manager; will invest if desirable; exceptional opportunity to secure a capable man. Address Box 554, AMERICAN MACHINIST.

OHIO

Tool designer and foreman wishes change; practical mechanic; 18 years' experience; A-1 references; location immaterial. Box 583, AMERICAN MACHINIST.

Tool room foreman, wide experience on tools for brass valves and fittings, wants to correspond with firm located in the West; age 38. Box 580, AMERICAN MACHINIST.

An experienced designing draftsman is open for position; 20 years' experience on Corliss steam engines, air compressors and rock drills; ambitious and capable; references, A-1. Box 577, AMERICAN MACHINIST.

PENNSYLVANIA

Machinist, experienced in cotton and worsted machinery, wants employment. Box 567, AMERICAN MACHINIST.

Mechanical engineer seeks position as master mechanic or superintendent; seventeen years' varied experience; uptodate on modern methods; good organizer and systematizer. Box 526, AMERICAN MACHINIST.

Mechanical engineer and designer, experienced on typewriter, adding machines and the like, special automatic machinery and tools, specialist in experimental design, a heavyweight, is open for engagement with a progressive firm. Box 551, AMER. MACHINIST.

Draftsman, 21, with several years' experience of cotton and worsted machinery, wants to change position. Box 568, AM. MACH.

Graduate mechanical engineer desires position as chief draftsman or engineer; seven years' practical experience, three years designing steam hammers and hydraulic presses, riveters, etc.; four years designing and maintaining the equipment of one of the large steel companies. Box 585, AMER. MACH.

FOREIGN

Engineer's patternmaker seeks employment in America; age 27; good experience; general engineering work; first class references. Box 564, AMERICAN MACHINIST.

FOR SALE

One large size new Sanford portable welding machine at sacrifice. Box 578, AM. MA.

Machine tool business; patterns, jigs, small tools; 500 machines in use; sold by best agents; bargain for anyone desiring to add to their line. "C. M. T.," AMER. MACHINIST.

For Sale—Various lots of high speed metal slotting saws and cutters, all special sizes; send in your specifications; can make very attractive prices. Stewart & Clark Mfg. Co., Chicago.

Manufacturing business; outright or part; dies, presses and special machinery; established trade with best concerns in the United States; reason sickness. Box X-40, AMERICAN MACHINIST, 150 Michigan Ave., Chicago.

For Sale—Kearney & Trecker Milwaukee milling machine No. 2; universal miller, in good condition, with universal dividing head, vise and arbor; vertical attachment, collets, countershaft, chuck, arm braces. Address Box 407, Waterbury, Conn.

For Sale—32 horsepower and 14 horsepower Backus gas engines, line shaft and other equipment; Bliss No. 30½ combination back geared and direct drive punch press; all of the above machines in the best of condition; can be seen at any time. Ellis Adding Typewriter Co., 204 Morris Ave., Newark, N. J.

Talks With Our Readers

By The Sales Manager

Many a man's efficiency is rated not by his own personal ability, but by the ability of his tools.

Which is perhaps only another way of saying it. For a man selects his tools according to his ability.

You must have the right tools in order to obtain best results.

Carnegie once said he did not himself create his fortune.

Rather it was the men with whom he surrounded himself who created it for him.

But these men were his tools.

He had the great gift of selecting the right tools for his purpose. And he is a shining example of how far a man may travel on the Road to Success if, after selecting the right tools, he uses them in the right way. Witness the library buildings on every other corner.

The standard of efficiency of equipment is constantly changing in a forward direction.

A machine justly termed efficient ten years ago could not be called that today.

The march of improvement is too rapid—the demand for lower operating costs too insistent.

You must not only start out with a knowledge of efficient apparatus; you must also know if that apparatus is the most efficient at the present time. You must keep track of all the improvements, of all the new machines and devices of sufficient importance to reduce costs, to increase production, to cut out the hard, back-breaking work or in some other way pay for their installation.

Now the question is: How are you going to know what is and what is not efficient equipment?

How are you going to tell whether the equipment you are using is giving top-notch results?

Or is there some newer device or some old device improved that will increase the plant's efficiency and, at the same time, lower costs.

The answer to these questions is almost obvious.

You must look to the pages of your technical paper—the advertising pages as well as the reading pages.

You have before you each week the advertisements of the largest and most reliable manufacturers of machine-shop equipment. Who are naturally eager to call your attention to that part of their product which is newest, most efficient and which is of the most value to you.

To illustrate, suppose you made arrangements with a clipping bureau.

A bureau which had a marvelous way of digging out the information which was new and of value to you in your work, and of supplying you with this information.

There is, of course, no such bureau possible.

And yet it is just this vital kind of information that the Selling Section of the AMERICAN MACHINIST brings to you every week.

You, as well as Carnegie, realize how important it is to surround yourself with the right tools.

Let the advertising pages of this paper help you in selecting these tools.

* * *

Only reliable products can be continuously advertised.